THE SMITH-BURDGE ARITHMETICS
INTERMEDIATE BOOK

WENTWORTH-SMITH MATHEMATICAL SERIES

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INTERMEDIATE BOOK

BY

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PREFACE

This series of arithmetics has been prepared not only to meet the requirements of the leading modern courses of study and to keep pace with the present progressive movement in the teaching of arithmetic, but also with the purpose of setting a new standard in the arrangement of material and in the development of the subject to meet the needs and interests of children.

The whole series has been based upon a recognition of the principle that the proper applications of arithmetic are found only in a socialized subject matter that appeals to the child's interest. The basal topics are so arranged that a pupil stays long enough with a subject at one time to acquire that feeling of mastery which is his right and privilege. Besides this, there are several other features which are noteworthy. One is the large amount of repeated drill upon the fundamental operations, which serves as the best possible preparation for modern tests; the second feature is the series of silent reading lessons by which the pupil enlarges his vocabulary without learning formal definitions that are of no interest and of but little value; the third feature is the Review and Drill section, placed near the end of each chapter, which furnishes a cumulative review of all preceding work; the fourth feature is the sets of Problems without Numbers and the Problems for Completion, each of which requires new lines of independent thought on the part of the pupils; and the fifth is the Little Examinations, a brief series of tests covering each chapter in turn.

By means of these features a teacher may be assured that the pupil's memory is kept refreshed upon those essentials of computation without which he cannot hope to succeed and that he is trained in independent thinking in arithmetic. There have also been inserted several elementary psychological tests relating to arithmetic, and an unusually large amount of drill material of the latest type, some or all of which should be used according to the needs of the class. Such features as the motivation of work, groups of problems relating to the interest and needs of childhood, timed tests, suggested projects, group contests, and the like will be found throughout the book. These features, however, are used in such a way as not to hinder the pupil's progress in learning to compute, which, after all, is the chief aim of arithmetic.

This book, which provides work for Grades V and VI, is arranged in four chapters, each of which covers the work of a half year as usually prescribed. Teachers should feel free to omit as many exercises as may be necessary to carry out a definite program. In general, teachers too often fail to realize the importance of omitting exercises in order to carry out such a program, and too many textbooks fail to supply sufficient material to permit a proper selection which shall take into account the individual differences of the pupils. In the Teachers' Manual accompanying this book there will be found detailed suggestions that will assist the teacher in further vitalizing the work of these grades.

DAVID EUGENE SMITH
HOWARD GRIFFITH BURDGE

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THE SMITH-BURDGE ARITHMETICS

INTERMEDIATE BOOK

CHAPTER I

I. FUNDAMENTAL OPERATIONS

A SILENT READING LESSON

Our common numerals are sometimes spoken of as Hindu, because it is believed that they were first used by the Hindus in ancient India. They are also spoken of as Arábic, because they were passed on to Europe by the Arabs.

We use also the Roman numerals, which are seen on clocks and watches. These numerals were used by most Europeans until about the time that America was discovered.

Our common numerals are more convenient than the Roman numerals, because we can write most numbers with fewer figures; for example, where we write 87 the Roman system requires LXXXVII.

If we write one after five, we have either 51 or VI. They do not have the same meaning, however, because 51 means $50 + 1$ and VI means $5 + 1$.

If we write ten, then five, and then one, we have 1051 or XVI. What is the difference in meaning?

A SILENT READING LESSON (CONTINUED)

Our numerals are better than any others, because we can easily write any number that we need to use by means of only ten different figures. The ten figures are

0 (zero), 1, 2, 3, 4, 5, 6, 7, 8, and 9.

In the number 51, 5 represents tens, because it is in tens' place; that is, in our system each figure has a *place value.*

It is easier to read a number like 3,248,630 if we separate it into *periods* of three figures each, beginning at the right. In a large number, the left-hand period may have one, two, or three figures. Periods are not commonly indicated in numbers of only four figures. We sometimes separate the periods by spaces instead of commas.

In telephoning, we read the number 4090 as "four-o-nine-o." Bookkeepers often read the number $4207.09 as "four-two-o-seven point o-nine."

A thousand million is called a *billion.* There are also names for larger numbers, which, however, are not used in practical life.

Billions	Millions	Thousands	Units
38,	435,	506,	147

The number shown at the right is read "thirty-eight billion four hundred thirty-five million five hundred six thousand one hundred forty-seven."

The figures 1, 2, 3, and so on to 9, and also their values, are sometimes called *digits.* Formerly, the writing of numbers was called *notation,* and the reading of numbers was called *numeration,* but as people seldom use these words today, we do not have to learn the definitions.

A LITTLE WRITING LESSON

Write answers to the following questions:

1. By looking at your fingers do you see why people came to count by tens? Why was it?

2. Some people, particularly in warmer parts of the earth where they went barefooted, used to count by twenties. Can you tell what the reason was?

3. Some people even now speak of a score, which means 20. From what ancient way of counting does this come?

4. In buying eggs do you count them by 10's? by 20's? by 12's? What name do we give to 12? Probably at one time many people usually counted by 12's.

5. What advantage has our method of writing nine (9) over the method the Romans used (IX)?

6. In writing 542, in which place is the 5? the 4? the 2?

7. In 26,623,054,689, what name has the period 689? the period 054? the period 623? the period 26?

8. What name do you give to 1000 thousand? One milli

9. How do you write in figures the number six million twenty-five thousand fifty-nine?

10. How do you write 3,492,006 in words?

11. How do you read the telephone number 3207?

Write the following in words:

12. \$6.25. **14.** 45,850. **16.** 230,438. **18.** 6,842,759.

13. \$0.37. **15.** 84,909. **17.** 700,007. **19.** 32,329,646.

20. Write in figures the number six million six.

A SILENT READING LESSON

We do not need to learn much about Roman numerals except to be able to read them on clocks, in the chapter numbers of books, in dates on buildings, or similar cases.

The twelve numerals on a clock face are as follows:

I (1)	**V** (5)	**IX** (9)
II (2)	**VI** (6)	**X** (10)
III (3)	**VII** (7)	**XI** (11)
IV or **IIII** (4)	**VIII** (8)	**XII** (12)

The Romans usually wrote IIII for four and VIIII for nine, but this is no longer the common way.

In writing Roman numerals we combine the following letters, usually capitals, according to the rules below:

Letters,	I	V	X	L	C	D	M
Values,	1	5	10	50	100	500	1000

1. *Writing a letter of less value after a letter of greater value indicates that the values are to be added.*

Thus, using V (5) and I (1), we have VI $= 5 + 1 = 6$.

2. *Writing a letter of less value before a letter of greater value indicates that the first value is to be subtracted.*

Thus, using I (1) and X (10), we have IX $= 10 - 1 = 9$.

3. *Repeating a letter indicates that its value is repeated.*

Thus, C $= 100$, and so CC $= 100 + 100 = 200$. Usually letters are not taken more than three times, but the old forms IIII for 4 and CCCC for 400 are exceptions.

ANOTHER WRITING LESSON

Write answers to the following questions:

1. In writing a number in Roman numerals, do you begin at the left or the right? Which is the easier way?

2. What does the year 1776 mean in the history of our country? How many figures do you use in writing this date with our common numerals? with Roman numerals?

M	=	1000
DCC	=	700
LXX	=	70
VI	=	6
MDCCLXXVI	=	1776

3. The Romans would have written the number 1928 as MDCCCCXXVIII. We often see 1928 written as MCMXXVIII. Write the present year and the next year in these two ways.

4. Write the tens in Roman numerals, from X to XC.

5. Write the hundreds from C to DCCCC (or CM).

6. After reading Chapter XXXIX of a book of sixty-four chapters, how many more chapters have you to read?

7. On the cornerstone of a church there is the date MDCCCLXXXVIII. When was the church built?

Write the following numbers in common numerals:

8. XIV. 10. XXV. 12. LXXI. 14. LXXXVII.

9. XVI. 11. XIX. 13. CXIX. 15. MDCCCCXXX.

Write the following numbers in Roman numerals:

16. 39. 17. 48. 18. 58. 19. 1775. 20. 1932.

OUR COMMON COINS AND BILLS

All work oral

1. How many cents make a nickel?

2. How many nickels make a dime? a quarter?

3. A dollar is how many cents? nickels? dimes?

4. Which would you rather have, 2 dimes, 3 nickels, and 4¢, or a quarter, a dime, and a nickel? Why?

5. Which would you rather have, a quarter, 3 dimes, 2 nickels, and 3¢, or a half dollar and a nickel? What is the difference in value?

6. Which would you rather have, a half dollar, a quarter, and a dime, or 3 quarters and 2 nickels? What is the difference in value, if any?

7. If you buy four ice-cream cones at 5¢ each, and give the clerk a quarter, how much change is due you?

8. If you are the clerk and have to give me 17¢ in change, how can you do it in the best way; that is, with the smallest number of coins?

9. If I am the clerk and have to give you 56¢ in change, how can I do it in the best way?

State the best way of giving change so as to take

10. 11¢ from 25¢.
11. 16¢ from 50¢.
12. 23¢ from 50¢.
13. 56¢ from 75¢.
14. 56¢ from $1.
15. 18¢ from 25¢.
16. 19¢ from 50¢.
17. 37¢ from 50¢.
18. 52¢ from 75¢.
19. 52¢ from $1.

A SILENT READING LESSON

Read, filling in the blanks as you read:

When we write $2 + 3 = 5$, we are adding 2 and 3, and the process is called ——.

The word *addends* is sometimes used for the numbers which we ——.

The result in addition may be called the ——.

Taking one number from another, as in $9 - 4 = 5$, is called ——.

In subtraction, the larger of the two given numbers is sometimes called the ——, and the smaller one the ——.

The result in subtraction may be called the ——.

One of the best checks to show that we have added correctly is to ——.

The best check to show that we have subtracted correctly is to —— the answer to the smaller number and to see if the result is the larger number.

In $3 + 7 + 2 + 8 + 9$, we can add more quickly by *grouping* the numbers like this: $(3 + 7) + (2 + 8) + 9$. We then see that $10 +$ —— $+ 9 =$ ——.

Instead of speaking of a minuend, we may simply speak of the number from which we ——.

Instead of speaking of the subtrahend, we may simply speak of the number to be ——.

Instead of using the words *sum* and *difference*, we may use simply the one word ——.

WRITTEN SPEED TEST CHART IN ADDITION

Add the numbers in the horizontal lines, grouping them conveniently; then add the numbers in the columns. Write the time taken after the last result:

	9.	10.	11.	12.	13.	14.	15.	16.	17.
1.	8	7	5	3	7	6	4	7	5
2.	2	3	5	2	8	6	4	3	7
3.	5	3	2	1	4	4	6	6	8
4.	5	7	8	9	1	4	2	8	4
5.	7	8	5	4	1	3	3	5	8
6.	3	2	5	1	9	7	3	6	6
7.	6	5	4	5	8	2	3	7	4
8.	4	5	6	5	2	8	7	3	8

	27.	28.	29.	30.	31.	32.	33.	34.	35.
18.	9	1	7	3	8	2	7	3	7
19.	2	8	7	3	5	5	3	7	6
20.	8	2	4	6	7	3	4	6	5
21.	7	7	6	7	3	8	2	4	6
22.	3	5	2	6	4	5	5	7	3
23.	2	4	4	3	7	1	9	8	2
24.	5	5	6	4	7	3	8	2	9
25.	1	9	7	3	2	8	4	6	6
26.	9	1	3	7	8	2	6	4	0

WRITTEN SPEED TEST CHART IN ADDITION

Copy the following examples and then, at a signal from the teacher, see how many columns you can add in 2 min.:

1.	4.	7.	10.	13.	16.	19.	22.	25.	28.
1	2	8	5	7	4	6	9	2	6
5	7	9	2	9	2	7	2	1	4
2	3	4	7	6	7	8	3	9	9
6	6	3	3	2	3	2	4	8	8
4	4	6	6	3	6	3	6	7	3
9	3	7	2	0	9	8	5	2	8

2.	5.	8.	11.	14.	17.	20.	23.	26.	29.
9	2	2	1	6	2	9	9	4	1
1	8	5	9	1	6	1	1	4	9
2	6	3	3	2	5	1	7	1	7
4	3	2	3	3	7	0	3	2	7
4	1	5	4	4	2	8	0	3	6
8	8	2	8	8	1	4	8	6	5

3.	6.	9.	12.	15.	18.	21.	24.	27.	30.
1	7	9	2	5	5	6	7	5	0
7	3	0	7	0	4	2	6	6	6
3	0	3	2	8	6	8	4	0	8
4	8	4	2	9	8	3	4	6	8
6	2	3	6	3	2	7	2	8	4
2	9	0	3	2	5	0	6	2	2

ORAL SPEED TEST CHART IN ADDITION

In the following additions state the results rapidly, seeing how long it takes you to do them all:

1. 24 6	10. 75 3	19. 70 30	28. 72 35	37. 85 22	46. 34 63
2. 34 6	11. 75 13	20. 73 30	29. 42 60	38. 25 82	47. 43 34
3. 36 4	12. 75 73	21. 42 65	30. 41 88	39. 51 49	48. 65 34
4. 67 3	13. 96 4	22. 42 63	31. 30 73	40. 51 69	49. 74 57
5. 77 3	14. 94 6	23. 46 63	32. 81 40	41. 61 69	50. 94 80
6. 88 2	15. 94 10	24. 85 15	33. 71 31	42. 52 69	51. 94 49
7. 88 3	16. 94 20	25. 87 15	34. 40 60	43. 59 72	52. 55 55
8. 48 10	17. 94 40	26. 87 5	35. 31 20	44. 30 10	53. 40 20
9. 49 2	18. 94 16	27. 87 13	36. 31 39	45. 35 95	54. 45 45

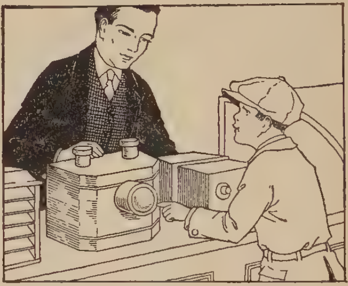
WRITTEN SPEED TEST CHART IN ADDITION

Place the edge of a sheet of paper under the first row of examples and add, writing only the answers. Then fold the answers under, and do the same for the next row, and so on. Write the results as rapidly as you can:

1.	26	42	28	36	57	63	29
	30	21	15	14	18	27	19
	14	13	10	22	16	30	24
2.	10	38	83	37	56	28	36
	14	22	9	42	49	27	48
	23	14	40	61	78	33	73
3.	21	53	75	29	29	38	85
	32	41	25	38	66	55	37
	41	66	32	67	75	16	44
	60	78	59	48	88	72	68
4.	26	33	18	67	48	54	33
	44	68	25	39	35	92	68
	25	42	32	56	29	61	79
	15	30	48	75	16	76	66
5.	12	22	32	33	40	22	12
	8	31	18	42	21	19	19
	20	6	70	20	27	38	27
	16	14	20	9	60	6	68
	24	13	15	16	19	11	23

PROBLEMS IN ADDITION

1. I bought a small radio set for \$12.25, a small phonograph for \$10.30, a small moving-picture machine for \$10.50, and a film for \$2.25. How much did I pay?



2. Find how much you would have to pay in all for a croquet set costing \$1.45, a set of tenpins costing \$1.20, a set of dominoes costing 95¢, a magic lantern costing \$3.75, and slides costing \$1.45.

3. A gas meter shows that in November a family used 3800 cu. ft. of gas; in December, 4400 cu. ft.; and in January, 4500 cu. ft. Find the total amount used.

4. On the Dixie Highway, connecting Chicago and Jacksonville, a man drove 168 mi. the first day, 157 mi. the second, 164 mi. the third, and 154 mi. the fourth. What was the total distance traveled?

Copy the following columns, add, and check by adding down instead of up. Write the time taken after the last result:

5.	6.	7.	8.	9.
\$2.75	\$3.42	\$5.20	\$3.92	\$5.75
3.40	2.68	2.40	4.78	2.25
.65	4.00	.80	.64	3.46
2.82	.75	6.00	.73	2.78
1.47	3.05	4.35	1.20	9.29
6.00	2.70	5.26	5.00	5.42
.95	1.55	7.88	2.73	2.80

DRILL CHART IN RAPID ADDITION

Without copying, add these columns, writing the results on the folded edge of a piece of paper placed under the examples. Write the time taken after the last result:

1. $13.48	5. $42.25	9. $19.75	13. $2738.75
26.31	37.06	9.25	3138.76
7.92	2.90	16.00	96.37
8.74	32.66	4.37	800.46
19.00	5.44	5.63	3517.38
2. $37.78	6. $17.36	10. $29.00	14. $3867.40
62.41	7.92	9.25	2209.46
39.29	18.00	16.37	500.73
8.76	.69	4.29	1529.96
29.29	32.20	15.39	4082.32
3. $21.23	7. $41.73	11. $50.00	15. $4887.95
7.68	62.81	7.45	196.75
.92	42.96	17.68	98.80
8.00	80.00	3.92	764.80
15.26	9.37	29.89	526.46
4. $35.52	8. $48.72	12. $51.25	16. $4240.35
7.28	9.68	72.00	280.98
16.93	18.43	6.86	3507.05
14.36	17.67	.78	3086.76
6.87	13.00	1.96	945.50
25.91	39.26	19.29	3095.05

Using Subtraction. John was born in a village in which 3204 people now live. The population was only 1728 when John was born. How much has the village grown?

Just as we count John's growth by the increase in inches or pounds, so we count the growth of the village by the increase in the number of people. That is, to find the answer to the question we must subtract 1728 from 3204.

Subtracting in the way already learned, we have 1476 for the result.

$$\boxed{\begin{array}{r} 3204 \\ \underline{1728} \\ 1476 \end{array}}$$

That is, there are 1476 more people.

Check. The work is right because

$$1476 + 1728 = 3204.$$

SUBTRACTING NUMBERS

Subtract as indicated, check each result, and write the time taken after the last result:

1. 3980 1296	**6.** 5870 2096	**11.** 7094 3396	**16.** 8060 3397	**21.** 9024 4579
2. 4238 2879	**7.** 6230 3915	**12.** 7230 2847	**17.** 6231 2806	**22.** 9000 4926
3. 7235 6686	**8.** 7202 6654	**13.** 9170 6694	**18.** 8500 5286	**23.** 9101 6794
4. 8231 6192	**9.** 3126 1792	**14.** 8207 6352	**19.** 3300 1927	**24.** 5121 3278
5. 7802 973	**10.** 5200 1275	**15.** 6173 2767	**20.** 7080 796	**25.** 6000 926

DRILL CHART IN RAPID SUBTRACTION

Copy and subtract, recording the time for each column:

1. 64,812 29,684	10. 72,302 68,474	19. 91,231 44,444	28. 42,070 16,720
2. 51,206 36,819	11. 30,123 19,468	20. 82,230 66,627	29. 50,273 39,182
3. 70,763 41,929	12. 67,329 30,538	21. 71,247 56,493	30. 61,791 48,072
4. 20,728 16,439	13. 80,230 57,629	22. 91,426 48,790	31. 70,000 24,303
5. 33,400 19,650	14. 20,726 9,829	23. 78,123 49,206	32. 82,573 49,696
6. 72,323 48,207	15. 70,000 13,520	24. 81,111 66,666	33. 80,042 28,768
7. 66,203 48,162	16. 82,121 68,237	25. 70,020 37,575	34. 50,000 6,809
8. 42,902 18,921	17. 61,123 46,327	26. 60,101 44,211	35. 52,121 16,809
9. 60,021 38,292	18. 73,291 47,182	27. 80,298 37,126	36. 67,123 48,070

DRILL CHART IN RAPID SUBTRACTION

Copy and subtract, recording the time for each column:

1. $950.00 652.90	10. $926.00 547.62	19. $884.75 615.28	28. 850,000 583,867
2. $527.63 343.56	11. $972.93 598.98	20. $824.70 652.35	29. 990,900 666,907
3. $675.62 181.98	12. $820.36 428.92	21. $504.76 362.97	30. 900,000 328,965
4. $570.06 9.99	13. $829.80 167.98	22. $800.10 469.86	31. 975,438 821,795
5. $802.68 469.81	14. $970.45 291.66	23. $708.07 298.78	32. 864,560 238,989
6. $906.97 423.49	15. $700.00 293.76	24. $709.16 387.68	33. 347,892 9,999
7. $729.81 49.93	16. $982.75 93.89	25. $508.76 235.92	34. 865,555 27,777
8. $824.75 568.45	17. $408.72 329.86	26. $700.00 387.50	35. 658,250 51,175
9. $402.25 387.56	18. $711.20 667.58	27. $898.05 509.79	36. 572,527 221,962

ORAL DRILL CHART IN MAKING CHANGE

1. If I buy goods costing 58¢ and hand the clerk $1, he makes change, saying, "58 and 2 are 60, and 10 are 70, and 5 are 75, and 25 makes $1." How much change does he give me?

Make change from 25¢ when you buy goods costing

2. 10¢.	4. 9¢.	6. 5¢.	8. 8¢.	10. 22¢.
3. 13¢.	5. 19¢.	7. 15¢.	9. 18¢.	11. 17¢.

Make change from 50¢ when you buy goods costing

12. 38¢.	14. 32¢.	16. 26¢.	18. 16¢.	20. 23¢.
13. 28¢.	15. 42¢.	17. 24¢.	19. 15¢.	21. 29¢.

Make change from $1 when you buy goods costing

22. 28¢.	24. 50¢.	26. 86¢.	28. 75¢.	30. 93¢.
23. 36¢.	25. 56¢.	27. 84¢.	29. 77¢.	31. 97¢.

Make change from $2 when you buy goods costing

32. $1.25.	34. $1.35.	36. $1.50.	38. $1.48.
33. $1.70.	35. $1.75.	37. $1.83.	39. $1.87.

Make change from $5 when you buy goods costing

40. $3.52.	42. $2.28.	44. $3.98.	46. $4.54.
41. $2.85.	43. $4.17.	45. $2.71.	47. $1.17.

Price List. Fred and Kate made the following price list of toys which they saw in a store window:

Air gun . . .	$1.25	Engine	$3.98
Airplane . . .	.69	Rubber ball . .	.89
Bank	.97	Taxi	.89
Basket ball . .	.98	Teddy bear . .	1.39
Box of tools . .	5.98	Train	3.45
Box of tricks .	.75	Tricycle . . .	6.98
Drum	1.19	Wheelbarrow . .	1.39

Use this list in the following problems.

BUYING TOYS

1. If you buy a train, how much change is due from $5?

2. If you buy a wheelbarrow, a box of tools, and a Teddy bear, they will cost how much less than $10?

3. Fred buys a rubber ball and a basket ball. How much change does he get from $5?

4. If you have $5 to spend, which toys should you choose from the above list so as to use nearly all the money? How much money should you have left?

5. Suppose that your class decided to send a box of toys to a children's hospital and that you had collected $15 for this purpose. Make a list of the toys that you would buy from the above list, find the total cost, and find how much you would have left from the $15.

6. Suppose that you buy all the toys in the above list, how much do you have to pay? How much change do you receive from $35?

BUYING THINGS AT A STORE

1. Suppose that you buy a fountain pen for $1.50 and a silver pencil for $1.25. How much do the two articles cost? How much change is due from a 5-dollar bill?

Add $1.50 and $1.25 to find the cost.	$1.50	$5.00
Then subtract $2.75 from $5.	1.25	2.75
The result is the change due.	$2.75	$2.25

2. If you buy a small radio set for $12.50 and a book on radio for $1.40, how much do you pay?

3. If you buy a suit for $17.10 and a hat for $2.25, how much do you pay? If you give the dealer two 10-dollar bills, how much change do you receive?

4. If you buy a camera for $5.75 and pay 75¢ for films, how much do you pay? How can you pay this amount with only three pieces of money?

5. If you spend $12.25 for a second-hand phonograph and $3.50 for records, how much change is due from $20?

6. Suppose that you wish to buy a rubber-stamp outfit for printing names and amounts. If the price is $2.15 and you have earned $1.75, how much more do you need?

7. If your father gives you $8 and you earn $3.75, how much more do you need to buy a small typewriter costing $13.50?

8. If you save $12.75 and your uncle gives you $5, how much more do you need to buy a radio set costing $19.25?

A SILENT READING LESSON

When Robert writes up his cash account, he puts the amounts that he receives on the left-hand page and the amounts that he pays on the right-hand page, like this:

Receipts					Payments				
May	6	Cash on hand	2	75	May	7	Tennis ball		30
	7	From father		20		8	Ball game		25
	8	From mother		10		9	Marbles		15
	8	Doing errands		25		10	Balance	2	60
			3	30				3	30
May	10	Cash on hand	2	60					

In Robert's account we see that the "cash on hand" on May 6 was \$2.75. With the ruled columns he does not need to write the dollar sign and the decimal point.

The three items on the left-hand page, 20¢, 10¢, and 25¢, show amounts that Robert received.

The three items, 30¢, 25¢, and 15¢, on the right-hand page show amounts that Robert paid out.

To find the *balance*, Robert first adds the receipts and finds that they amount to \$3.30. He then adds the payments and finds that they amount to 70¢. He then subtracts 70¢ from \$3.30, and writes the result, \$2.60, as the balance on the right side. He carries this to the left-hand side as "cash on hand." The double rules across the page show that the account was *balanced* at this point.

KEEPING A CASH ACCOUNT

Rule some paper to show the left and right pages of a cash account, like the one on page 20. Then make out the accounts in Exs. 1–3, balancing each one on the last date given:

1. Receipts: May 6, cash on hand, \$3.20; May 7, from father, 30¢; May 8, from mother, 25¢; May 9, errands, 30¢. Payments: May 7, movies, 20¢; May 9, banana, 4¢; May 9, pencil, 6¢.

2. Receipts: Feb. 1, cash on hand, \$2.75; Feb. 2, errands, 40¢; Feb. 3, helping on cleaning car, 35¢. Payments: Feb. 2, wire for radio, 65¢; Feb. 3, radio magazine, 25¢; Feb. 4, knife, 75¢.

3. Receipts: June 3, cash on hand, \$4.62; June 3, errands, 60¢; June 4, selling papers, 52¢; June 6, gardening, 45¢. Payments: June 4, book on radio, 85¢.

4. Make out a cash account with the following items, and balance it on May 31. Receipts: May 24, cash on hand, \$13.20; May 25, J. L. Roe, \$3.20; May 26, F. J. Case, \$2.75; May 27, N. P. Doe, \$1.80; May 29, A. B. Coe, \$4.20. Expenses: May 29, cap, \$1.35; May 30, bathing suit, \$2.25.

5. Make out a cash account with the following items, and balance it on Dec. 9. Receipts: Dec. 6, cash on hand, \$145.80; Dec. 6, M. P. Jones, \$85.70; Dec. 7, A. B. Smith, \$68.90; Dec. 8, P. H. Haynes, \$38.25. Expenses: Dec. 6, rent, \$85; Dec. 7, salaries, \$75; Dec. 8, coal, \$28.60; Dec. 8, account book, \$2.50; Dec. 8, telephone, \$5.80; Dec. 8, gas bill, \$4.75; Dec. 8, stationery, \$3.50.

Copy and balance each of the following accounts:

6.

Receipts		Payments	
1726	48	639	82
492	00	375	40
1237	42	1825	50
1050	75	88	92
128	68	*Balance*	

7.

Receipts		Payments	
1075	85	842	60
1293	42	1387	65
878	68	29	82
975	00	1000	00
320	72	*Balance*	

8.

Receipts		Payments	
1582	83	1127	20
298	30	176	39
3400	00	2173	48
1287	64	976	92
2176	92	1106	54
384	08	*Balance*	

9.

Receipts		Payments	
1720	91	1000	00
8000	00	278	92
625	43	1072	65
1426	00	2575	00
782	00	*Balance*	

10.

Receipts		Payments	
3075	00	2000	00
296	82	342	75
1921	32	1282	60
1072	00	928	34
800	00	*Balance*	

11.

Receipts		Payments	
3802	42	3015	24
2173	60	2432	30
984	38	874	60
2500	00	1687	52
3078	06	943	70
984	37	*Balance*	

USING WHAT YOU HAVE LEARNED

1. The expense account of a family showed the following items for June: Food, \$48.50; rent, \$60; gas for cooking, \$3.35; clothing, \$32.50; insurance, \$17.75; church and charity, \$6.50; amusements, \$4.80; maid's wages, \$45; incidentals, \$15.80. If the family income was \$250 for that month, how much could be saved?

2. If a book has 275 pages, and if, starting at page 1, you read 38 pages on Monday, 23 on Tuesday, and 36 on Wednesday, how many pages have you read? How many more pages have you to read?

3. Last month Mr. Sinclair paid \$110 for rent, \$137.50 for food, \$72.80 for clothing, \$16.20 for books and magazines, \$4.50 for church and charity, and \$15.20 for amusements. If his income that month was \$360, how much money did he have left?

4. On an automobile trip of 641 mi. a man and his family went 139 mi. the first day, 147 mi. the second day, 98 mi. the third day, and 126 mi. the fourth day. How many more miles had they to go?

5. A farmer has 120 A. (acres) of corn in three fields. The first field contains 36 A. and the second 34 A. How many acres are there in the third field? This is how many more acres than there are in the first field?

6. In a year when a farmer's accounts showed his income to be \$8940.78, he received \$2286.65 from the sale of hogs and \$2792.87 from the sale of cattle. What was his income from other sources besides hogs and cattle?

A SILENT READING LESSON

Read, filling in the blanks as you read:

Multiplying one number by another is called ——. Thus, if we take 3 twice, we are using ——. We may write

$$2 \times 3 = \text{——}.$$

The number multiplied may be called the ——, which in the case at the right is ——.

48
7
336

The number by which we multiply may be called the ——, which in this case is ——.

The result in multiplication is sometimes called the ——, which in this case is ——.

When two whole numbers are multiplied, the result is called a *multiple* of either one of the numbers. For example, 35 is a —— of 5 and also of ——.

Numbers like 2 and 5, which have no names such as "feet" or "pounds" written after them, are called *abstract numbers*. When such names are written, the numbers are called *concrete numbers*. For example, 17 and $2\frac{3}{4}$ are —— numbers, and 6 ft. and 15¢ are —— numbers.

A whole number (not including 1 or the number itself) that is exactly contained in another is called a *factor* of that number. For example, 2, 3, 4, and 6 are factors of 12. The factors of 30 are 2, ——, ——, 6, ——, and 15.

If we multiply a number by itself any number of times, the result is called a *power* of the number. For example, $2 \times 2 = 4$, and so we call 4 the *second power* (or *square*) of 2, and we write $2^2 = 2 \times 2 = 4$. In the same way, because $2 \times 2 \times 2 = 8$, we write $2^3 = 8$ and say that 8 is the *third power* (or *cube*) of 2.

ORAL DRILL CHART ON EASY COMBINATIONS

1. Two or three years ago we learned all the combinations of two numbers, of one figure each, that we shall need in multiplication. Do we know them now? Do we know one combination, like 8×7, as well as any other, like 2×1? We must do so if we are to multiply easily and quickly. Try 9×6 and 7×9.

See if you can do all these multiplications in 1 min.:

2.	1	1	0	3	2	0	4	0	2	0
	2	1	1	1	2	2	1	9	3	3
3.	1	1	2	8	8	3	5	0	0	3
	0	3	1	2	0	2	1	7	0	4
4.	9	3	2	4	1	6	1	0	5	4
	0	3	0	2	4	1	5	4	0	3
5.	7	5	2	7	5	5	3	1	6	1
	1	2	4	0	3	5	0	6	2	7
6.	1	8	4	6	0	9	0	7	6	0
	9	1	0	8	8	1	5	2	0	6
7.	2	1	2	3	2	7	4	4	5	6
	5	8	6	5	7	3	9	5	8	4
8.	9	2	2	8	3	3	9	8	9	4
	2	8	9	2	9	8	3	3	4	8

DRILL CHART ON TROUBLESOME COMBINATIONS

In these multiplications, see if you can give orally all the results in 1 min.:

1.	5	4	8	4	6	5	4	4	5	7
	4	5	3	8	4	5	6	7	8	9
2.	6	5	2	5	9	6	6	7	6	6
	3	7	9	6	3	8	5	4	9	6
3.	7	8	6	8	7	7	8	7	8	5
	6	9	7	4	5	7	6	8	5	9
4.	8	9	9	9	9	9	9	4	9	8
	7	6	9	4	8	2	5	9	7	8

See if you can give the results in these specially troublesome cases, some of which are repeated, in 1 min.:

5.	9	8	7	7	8	5	5	2	7	9
	5	7	5	8	9	5	9	9	6	9
6.	9	9	5	8	9	7	6	4	8	3
	4	3	8	7	7	4	5	9	4	9
7.	8	9	5	7	7	5	8	4	9	6
	6	6	6	7	9	7	8	7	8	8
8.	4	6	9	7	6	9	8	6	6	8
	8	6	8	9	8	9	5	7	9	8

A SILENT READING LESSON

Read, filling in the blanks as you read:

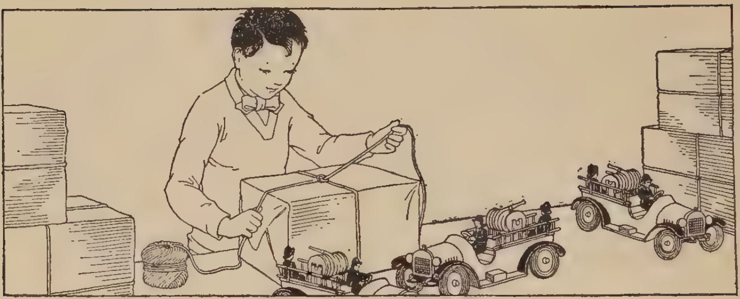
Here are three examples in multiplication. In (1) we first multiply by ——, then by —— (which is one ten), and then by —— (which is 2 ——). We then add. The final result is ——. We know where to put the decimal point because there are —— decimal places in $635.52.

(1)		(2)		(3)	
	$635.52		3247		3247
	215		1305		1350
	317760		16235		162350
	63552		9741		9741
	127104		3247		3247
	$136636.80		4237335		4383450

In (2) we first multiply by ——. We do not need to multiply by 0 tens because we know that the result would be ——. We next multiply by —— hundreds and write the 1 in hundreds' place. We next multiply by —— thousand and write the 7 in —— place. The final result is ——.

In (3) we first multiply by 0, which is done by placing a zero in units' place. We then multiply by 5, then by 3, and then by 1. The final result is ——.

If we wish to multiply a number by 207, we first multiply by ——. We need not multiply by —— because we know that the result would be ——. We then multiply by —— hundreds, being careful to write the right-hand figure in —— place. We then —— these two results.



FILLING MAIL ORDERS

1. Imagine that you are a clerk in the toy department of a large mail-order business house, and that you have to ship 16 toy fire engines which cost \$1.19 each. How much is received for these toys?

As in Ex. 1, suppose that you ship the following toys:

2. 12 steam tractors @ \$6.98. The symbol @, which means "at," refers to the price of each toy.

3. 72 small motion-picture films @ \$1.98.

4. 34 trains of cars @ \$4.98.

5. 128 taxis @ 89¢ and 97 garages @ 92¢.

6. 75 mouth organs @ 11¢ and 18 nickel trumpets @ 39¢.

7. 6 sets of building blocks @ 96¢, 12 sets of water color paints @ 96¢, and 24 bears on wheels @ 96¢.

8. If you have just filled an order for 8 boys' carts which amounted to \$25.20, and the next order calls for 48 carts of the same kind, to how much does the second order amount? In this case $48 = 6 \times 8$, and so the 48 carts sell for how many times \$25.20?

SPEED TEST CHART IN CARRYING

1. In multiplying 48 by 7, we think first "seven 8's are 56," and then "seven 4's are 28, and 5 are 33." That is, we have

$$7 \times 4 + 5 = 33,$$

in which we carry the 5. Try $3 \times 2 + 1$ and $3 \times 5 + 2$ for a start.

$$\begin{array}{r} 48 \\ 7 \\ \hline 336 \end{array}$$

Without repeating the statements, see how many results you can give orally in 2 min.:

2. $2 \times 1 + 1$.	**15.** $2 \times 2 + 1$.	**28.** $4 \times 1 + 2$.
3. $3 \times 1 + 1$.	**16.** $3 \times 4 + 2$.	**29.** $2 \times 5 + 1$.
4. $3 \times 5 + 1$.	**17.** $3 \times 9 + 2$.	**30.** $3 \times 7 + 1$.
5. $4 \times 1 + 1$.	**18.** $3 \times 3 + 1$.	**31.** $4 \times 3 + 1$.
6. $3 \times 2 + 2$.	**19.** $4 \times 2 + 1$.	**32.** $2 \times 8 + 1$.
7. $3 \times 6 + 1$.	**20.** $3 \times 6 + 3$.	**33.** $3 \times 3 + 2$.
8. $2 \times 3 + 1$.	**21.** $3 \times 9 + 1$.	**34.** $4 \times 2 + 2$.
9. $4 \times 1 + 3$.	**22.** $2 \times 4 + 1$.	**35.** $2 \times 9 + 1$.
10. $3 \times 7 + 2$.	**23.** $4 \times 2 + 3$.	**36.** $3 \times 8 + 1$.
11. $2 \times 6 + 1$.	**24.** $4 \times 3 + 2$.	**37.** $4 \times 3 + 3$.
12. $3 \times 4 + 1$.	**25.** $2 \times 7 + 1$.	**38.** $2 \times 0 + 1$.
13. $3 \times 8 + 2$.	**26.** $3 \times 2 + 1$.	**39.** $3 \times 0 + 2$.
14. $3 \times 1 + 2$.	**27.** $3 \times 6 + 2$.	**40.** $4 \times 0 + 3$.

SPEED TEST CHART IN CARRYING

Without repeating the statements, see how many of the results in Exs. 1–30 you can give orally in 2 min.:

1. $4 \times 5 + 3$.	11. $4 \times 4 + 1$.	21. $4 \times 8 + 3$.
2. $4 \times 8 + 2$.	12. $4 \times 8 + 1$.	22. $4 \times 6 + 1$.
3. $4 \times 4 + 2$.	13. $4 \times 5 + 2$.	23. $5 \times 2 + 2$.
4. $4 \times 7 + 2$.	14. $4 \times 9 + 1$.	24. $4 \times 5 + 1$.
5. $5 \times 2 + 4$.	15. $4 \times 4 + 3$.	25. $6 \times 1 + 5$.
6. $4 \times 7 + 3$.	16. $4 \times 6 + 2$.	26. $5 \times 2 + 3$.
7. $4 \times 9 + 2$.	17. $6 \times 2 + 2$.	27. $6 \times 1 + 4$.
8. $4 \times 6 + 3$.	18. $5 \times 2 + 1$.	28. $4 \times 7 + 1$.
9. $6 \times 2 + 1$.	19. $4 \times 9 + 3$.	29. $5 \times 1 + 4$.
10. $6 \times 2 + 5$.	20. $6 \times 2 + 3$.	30. $6 \times 2 + 4$.

See how many of these you can do in 2 min.:

31. $7 \times 6 + 4$.	41. $8 \times 6 + 6$.	51. $7 \times 7 + 4$.
32. $8 \times 6 + 7$.	42. $7 \times 6 + 5$.	52. $7 \times 8 + 4$.
33. $7 \times 7 + 5$.	43. $8 \times 7 + 6$.	53. $9 \times 6 + 8$.
34. $9 \times 6 + 6$.	44. $7 \times 8 + 6$.	54. $7 \times 6 + 6$.
35. $8 \times 8 + 6$.	45. $9 \times 6 + 7$.	55. $8 \times 7 + 7$.
36. $7 \times 7 + 6$.	46. $8 \times 9 + 7$.	56. $9 \times 8 + 6$.
37. $8 \times 8 + 7$.	47. $7 \times 8 + 5$.	57. $9 \times 6 + 4$.
38. $7 \times 9 + 6$.	48. $9 \times 9 + 7$.	58. $7 \times 9 + 5$.
39. $9 \times 9 + 6$.	49. $9 \times 8 + 8$.	59. $9 \times 6 + 5$.
40. $8 \times 9 + 6$.	50. $9 \times 9 + 8$.	60. $9 \times 7 + 8$.

USING WHAT YOU HAVE LEARNED

1. Flour is sold in different sized sacks, some of which weigh about 24 lb., others 12 lb., and others 6 lb. How many pounds are there in 125 sacks of the large size? of the medium size? of the small size?

2. If the average amount of meat eaten in a year is 194 lb. for each person, how many pounds will be eaten yearly in a village in which there are 2450 people?

3. Mr. Kane saves $6.75 out of his wages each week. How much does he save in 26 wk.? in 52 wk.? in 104 wk.?

4. Mr. Roberts put in 14 T. (tons) of coal costing $11.25 a ton. In the cellar he already had 3 T. for which he had paid $10.75 a ton. Find the cost of all the coal in the cellar.

5. Mr. Sinclair owns a house and a garage, which he rents to Mr. Robinson at $67.50 a month for the house and $7.50 a month for the garage. How much rent does he receive from Mr. Robinson in a year?

Find the total cost in each of the following cases:

6. 175 automobiles at $875.50 each.

7. 136 cows at $97.50 each.

8. 146 tires at $32.50 each, and 128 at $48.75 each.

9. 112 stoves at $78.24 each, and 69 at $87.36 each.

10. 136 horses at $157.50 each, and 96 at $178.50 each.

11. 128 chairs at $5.35 each, and 64 more at $5.35 each.

12. 1208 camp chairs at $1.08 each, 96 tents at $29.48 each, and 650 camp tables at $1.08 each.

A SILENT READING LESSON

Using the following short cuts will save time and work:

To multiply a whole number by 10, annex a zero; by 100, annex two zeros; by 1000, annex three zeros.

For example, $10 \times 27 = 270$,
and $100 \times 41 = 4100$.

To multiply a number representing United States money by 10, move the decimal point one place to the right; by 100, move the decimal point two places to the right; and so on.

For example, $100 \times \$3.17 = \$317$,
and $1000 \times \$5.26 = \$5260$.

To multiply by numbers like 20, 30, 200, 300, and so on, multiply by the 2 or 3 and annex zeros as necessary.

For example, to multiply 27 by 20, multiply by 2 and annex a zero. Similarly, to multiply \$362 by 700, multiply by 7 and annex two zeros.

To multiply \$25.16 by 300, multiply by 3 and move the decimal point two places to the right.

To multiply by 5, multiply by 10 and divide by 2.

For example, $5 \times 428 = 4280 \div 2 = 2140$.

To multiply by 50, multiply by 100 and divide by 2.

For example, $50 \times 344 = 34{,}400 \div 2 = 17{,}200$.

To multiply by 25, multiply by 100 and divide by 4.

For example, $25 \times 424 = 42{,}400 \div 4 = 10{,}600$,
and $25 \times \$16.80 = \$1680 \div 4 = \$420$.

DRILL CHART IN MULTIPLICATION

Multiply, in turn, by 2, 20, and 200:

1. 245.	3. 287.	5. 509.	7. 827.
2. $2.45.	4. $2.87.	6. $50.90.	8. $82.70.

Multiply, in turn, by 3, 30, and 300:

9. 682.	11. 725.	13. 933.	15. 1640.
10. $6.82.	12. $72.50.	14. $93.30.	16. $16.40.

Multiply, in turn, by 40, 400, 50, and 500:

17. 536.	19. 721.	21. 663.	23. 842.
18. $6.35.	20. $5.93.	22. $4.34.	24. $23.81.

Multiply $734.65 by

25. 9. 26. 90. 27. 900. 28. 970. 29. 907.

Multiply $875.40 by

30. 8. 31. 80. 32. 800. 33. 808. 34. 880.

Multiply $624.45 by

35. 7. 36. 70. 37. 700. 38. 707. 39. 777.

Perform the following multiplications:

40. 5280 ft. 210	43. $540.12 9000	46. $412.50 6500
41. 2932 ft. 680	44. $215.42 7000	47. $421.77 2900
42. 1460 ft. 170	45. $372.60 5000	48. $575.75 9200

USING WHAT YOU HAVE LEARNED

1. If each of the 88,756 persons in a certain county saves an average of $25 a year on the money spent for food, how much is the total saving in a year?

2. In the fall a woman bought 80 bu. of potatoes for her boarding-house. She estimated that during the winter she lost 15¢ per bushel on account of the potatoes' rotting. How much money did she lose in all?

3. If there are 2860 soldiers in a certain regiment, and the government pays 45¢ a day for food for each soldier, what is the cost of the food during the month of June?

4. When wheat advanced in price from $1.25 per bushel to $2.05 per bushel, how much more did a farmer receive from 90 A. which yielded 23 bu. of wheat per acre?

5. The average amount of meat eaten yearly by each person in this country is 194 lb. If 91 lb. per person is sufficient, what is the extra cost at 25¢ per pound?

6. Mr. Mann sold 40 barrels of apples to Mr. Smith for $3.50 a barrel at the orchard. Mr. Smith shipped them to a dealer in the city, and figured the cost of shipping and his profit at $1.17 a barrel. How much did the dealer pay Mr. Smith? How much more did the dealer pay for all the apples than Mr. Smith paid Mr. Mann?

7. A man who paid $57.50 a month for a city apartment had to furnish his own heat. In one year he used 9 T. of coal, for which he paid $12.50 a ton. The next year he moved into a heated apartment for which he paid $88.50 a month. Find the increase in his expenses for a year.

DRILL CHART IN MULTIPLICATION

Perform the following multiplications, writing the time taken for each column:

1. 798 × 798.	10. 50 × 836.	19. 153 × 8129.
2. 352 × 324.	11. 80 × 906.	20. 166 × 6666.
3. 682 × 726.	12. 51 × 4437.	21. 191 × 3473.
4. 823 × 983.	13. 93 × 7080.	22. 222 × 4646.
5. 435 × 481.	14. 69 × 7236.	23. 207 × 2007.
6. 632 × 408.	15. 83 × 8192.	24. 767 × 7873.
7. 563 × 481.	16. 54 × 7762.	25. 328 × 5362.
8. 408 × 662.	17. 36 × 8087.	26. 50 × $68.08.
9. 621 × 826.	18. 49 × 9246.	27. 60 × $42.75.

Multiply each number by each one at the right of it, and also multiply each number by each one below it, doing only those that the teacher tells you to do:

	37.	38.	39.	40.	41.	42.
28.	243	307	442	581	226	822
29.	376	476	208	622	642	344
30.	405	921	179	389	379	296
31.	221	330	643	427	496	473
32.	392	407	827	462	577	892
33.	470	920	906	330	640	487
34.	689	821	432	448	807	745
35.	573	139	507	229	488	307
36.	349	427	572	946	399	700

A SILENT READING LESSON

Read, filling in the blanks as you read:

In division we are given two numbers, and have to find a third. The number by which we divide is sometimes called the ——. Thus, if we divide 8 by 2, the divisor is ——.

The number divided is sometimes called the ——, and the result is sometimes called the ——. In $8 \div 2 = 4$, —— may be called the dividend, and —— the quotient.

There are several ways of indicating the division of 8 by 2; for example,

(1) A simple way often used in school is $8 \div 2 = 4$;

(2) Another way often used in school is $\begin{array}{r} 4 \\ 2\overline{)8} \end{array}$;

(3) A common way in practical work is $\begin{array}{r} 2)8 \\ \hline 4 \end{array}$;

(4) Another way is to use a fraction, as in $\frac{8}{2} = 4$.

Each of these is read "8 divided by —— equals ——."

Division is *exact* when there is no *remainder*. For example, $\frac{8}{2} = 4$, or $8 \div 2 = 4$, represents exact ——.

The case of $9 \div 2 = 4$, with 1 left over, is not one of exact division, because there is a remainder of ——.

When we divide 9 by 2, we may write —— as the whole number in the result, and then write the 1 over the 2. That is, we write the complete result as ——.

The result in addition may be called the ——; the result in subtraction, the ——; the result in multiplication, the ——; and the result in division, the ——. We may use the word *result* in any of these cases, and it is just as well to do so.

If we divide \$8 by \$4, the result must be ——; for we see that \$4 is contained in \$8 —— times.

If we divide \$8 by 2, we separate \$8 into —— equal parts, and there must be \$ —— in each part; that is, we have taken $\frac{1}{2}$ of \$8.

Thus, there are two different kinds of division; namely,

$$\$8 \div \$4 = 2,$$

and

$$\$8 \div 2 = \$4.$$

We can easily check our work in division, for we know that $8 \div 4 = 2$ is correct if $2 \times 4 =$ ——.

Here are three examples in division. The two at the left are examples of *short division*, and the one at the right is an example of —— *division.*

$$\begin{array}{r} 72 \\ 2\overline{)144} \\ \text{or} \\ 2\underline{)144} \\ 72 \end{array} \qquad \begin{array}{r} 14 \\ 13\overline{)182} \\ \underline{13} \\ 52 \\ \underline{52} \end{array}$$

The practical man writes the result in short division below the number ——, because it is more convenient for him to use the result in some other operation when it is written in this way. He cannot do this in long division, and so writes the result above the number divided.

$$\begin{array}{r} \$12.27 \\ 3\overline{)\$36.81} \end{array} \quad \text{or} \quad \begin{array}{r} 3\underline{)\$36.81} \\ \$12.27 \end{array}$$

In these divisions we see that the number by which we divide is ——; the number divided is ——; and the result is ——. In the case at the left we place the decimal point in the result exactly —— the —— —— in the number divided; in the case at the right, we place it ——.

SPEED TEST CHART ON EASY COMBINATIONS

In order to find out whether you have forgotten any of the combinations in division or whether you know all equally well, see if you can state these results in 2 min.:

1. 1 ÷ 1	6 ÷ 3	3 ÷ 3	8 ÷ 1	4 ÷ 2
2. 0 ÷ 4	2 ÷ 1	5 ÷ 5	2 ÷ 2	0 ÷ 8
3. 6 ÷ 2	0 ÷ 9	9 ÷ 3	0 ÷ 1	4 ÷ 4
4. 8 ÷ 4	8 ÷ 2	3 ÷ 1	0 ÷ 7	8 ÷ 8
5. 0 ÷ 2	0 ÷ 5	6 ÷ 6	4 ÷ 1	5 ÷ 1
6. 7 ÷ 7	7 ÷ 1	9 ÷ 1	0 ÷ 3	12 ÷ 6
7. 0 ÷ 6	21 ÷ 3	3 ÷ 3	10 ÷ 2	15 ÷ 3
8. 9 ÷ 9	12 ÷ 2	2 ÷ 2	12 ÷ 4	14 ÷ 2
9. 6 ÷ 1	10 ÷ 5	4 ÷ 4	12 ÷ 3	77 ÷ 7
10. 6 ÷ 3	60 ÷ 3	9 ÷ 9	30 ÷ 3	300 ÷ 3
11. 4 ÷ 2	40 ÷ 2	8 ÷ 8	20 ÷ 2	200 ÷ 2
12. 5 ÷ 5	50 ÷ 5	8 ÷ 2	40 ÷ 4	400 ÷ 4
13. 9 ÷ 3	90 ÷ 3	18 ÷ 2	90 ÷ 9	900 ÷ 9
14. 7 ÷ 7	70 ÷ 7	16 ÷ 2	80 ÷ 8	800 ÷ 8
15. 8 ÷ 4	80 ÷ 4	18 ÷ 3	80 ÷ 2	800 ÷ 2
16. 9 ÷ 1	90 ÷ 1	60 ÷ 2	00 ÷ 2	000 ÷ 2
17. 0 ÷ 2	22 ÷ 2	20 ÷ 4	25 ÷ 1	600 ÷ 3

SPEED TEST CHART ON TROUBLESOME COMBINATIONS

See if you can state all these results in $1\frac{1}{4}$ min.:

1.	$27 \div 3$	$18 \div 6$	$28 \div 7$	$20 \div 4$	$48 \div 8$
2.	$24 \div 4$	$21 \div 7$	$90 \div 9$	$24 \div 6$	$36 \div 9$
3.	$14 \div 7$	$20 \div 2$	$25 \div 5$	$35 \div 7$	$27 \div 9$
4.	$56 \div 7$	$28 \div 4$	$30 \div 6$	$40 \div 8$	$42 \div 7$
5.	$16 \div 4$	$49 \div 7$	$15 \div 5$	$30 \div 5$	$64 \div 8$
6.	$36 \div 6$	$35 \div 5$	$32 \div 4$	$70 \div 7$	$32 \div 8$
7.	$20 \div 5$	$36 \div 4$	$60 \div 6$	$81 \div 9$	$18 \div 9$
8.	$40 \div 5$	$72 \div 9$	$63 \div 7$	$24 \div 8$	$16 \div 8$
9.	$24 \div 3$	$54 \div 6$	$45 \div 5$	$48 \div 6$	$40 \div 4$
10.	$45 \div 9$	$42 \div 6$	$54 \div 9$	$56 \div 8$	$63 \div 9$

See if you can state these especially troublesome ones, some of which are repeated, in 1 min.:

11.	$54 \div 9$	$36 \div 6$	$42 \div 7$	$81 \div 9$	$54 \div 6$
12.	$64 \div 8$	$32 \div 8$	$63 \div 7$	$49 \div 7$	$40 \div 8$
13.	$63 \div 9$	$45 \div 9$	$40 \div 8$	$90 \div 9$	$72 \div 9$
14.	$56 \div 8$	$56 \div 7$	$64 \div 8$	$49 \div 7$	$36 \div 9$
15.	$48 \div 6$	$45 \div 5$	$48 \div 8$	$56 \div 8$	$72 \div 8$
16.	$81 \div 9$	$56 \div 7$	$72 \div 9$	$63 \div 9$	$42 \div 6$

DRILL CHART IN SHORT DIVISION

In the following, state the results as rapidly as you can:

1.	$2\overline{)20}$	$2\overline{)24}$	$2\overline{)42}$	$\frac{1}{2}$ of 48	$\frac{1}{2}$ of 84
2.	$3\overline{)21}$	$3\overline{)36}$	$3\overline{)63}$	$\frac{1}{3}$ of 96	$\frac{1}{3}$ of 69
3.	$4\overline{)24}$	$4\overline{)36}$	$4\overline{)48}$	$\frac{1}{4}$ of 84	$\frac{1}{4}$ of 56
4.	$5\overline{)35}$	$5\overline{)45}$	$5\overline{)55}$	$\frac{1}{5}$ of 60	$\frac{1}{5}$ of 80
5.	$6\overline{)36}$	$6\overline{)42}$	$6\overline{)54}$	$\frac{1}{6}$ of 72	$\frac{1}{6}$ of 96
6.	$7\overline{)42}$	$7\overline{)49}$	$7\overline{)63}$	$\frac{1}{7}$ of 84	$\frac{1}{7}$ of 91
7.	$8\overline{)56}$	$8\overline{)64}$	$8\overline{)88}$	$\frac{1}{8}$ of 96	$\frac{1}{8}$ of 104
8.	$9\overline{)63}$	$9\overline{)81}$	$9\overline{)27}$	$\frac{1}{9}$ of 45	$\frac{1}{9}$ of 144
9.	$7\overline{)98}$	$4\overline{)96}$	$5\overline{)85}$	$\frac{1}{3}$ of 51	$\frac{1}{4}$ of 680
10.	$4\overline{)52}$	$3\overline{)60}$	$2\overline{)94}$	$\frac{1}{4}$ of 68	$\frac{1}{6}$ of 222
11.	$4\overline{)72}$	$6\overline{)78}$	$3\overline{)57}$	$\frac{1}{5}$ of 95	$\frac{1}{8}$ of 144
12.	$6\overline{)84}$	$7\overline{)84}$	$8\overline{)96}$	$\frac{1}{9}$ of 72	$\frac{1}{8}$ of 104
13.	$5\overline{)70}$	$8\overline{)32}$	$7\overline{)91}$	$\frac{1}{7}$ of 63	$\frac{1}{9}$ of 225
14.	$3\overline{)93}$	$6\overline{)60}$	$5\overline{)65}$	$\frac{1}{4}$ of 88	$\frac{1}{8}$ of 248
15.	$7\overline{)77}$	$4\overline{)76}$	$8\overline{)48}$	$\frac{1}{6}$ of 84	$\frac{1}{10}$ of 100
16.	$5\overline{)95}$	$3\overline{)78}$	$6\overline{)78}$	$\frac{1}{9}$ of 54	$\frac{1}{10}$ of 120
17.	$3\overline{)69}$	$6\overline{)96}$	$8\overline{)72}$	$\frac{1}{5}$ of 85	$\frac{1}{12}$ of 144

DRILL CHART IN SHORT DIVISION

1. If you have 15¢ with which to buy 2-cent stamps, how many stamps can you buy, and how much money will be left? In such cases, you may say "7, and 1¢ over."

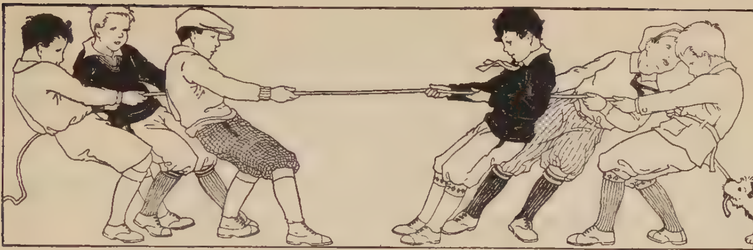
State the results, including the remainders, in the following cases as rapidly as you can:

2. 25 ÷ 6.	19. 58 ÷ 9.	36. 39 ÷ 9.
3. 76 ÷ 9.	20. 75 ÷ 9.	37. 68 ÷ 9.
4. 33 ÷ 4.	21. 66 ÷ 9.	38. 47 ÷ 5.
5. 59 ÷ 8.	22. 34 ÷ 5.	39. 68 ÷ 7.
6. 66 ÷ 7.	23. 38 ÷ 8.	40. 24 ÷ 7.
7. 68 ÷ 8.	24. 45 ÷ 6.	41. 39 ÷ 4.
8. 26 ÷ 6.	25. 26 ÷ 5.	42. 22 ÷ 7.
9. 35 ÷ 8.	26. 27 ÷ 7.	43. 69 ÷ 9.
10. 82 ÷ 9.	27. 59 ÷ 9.	44. 42 ÷ 8.
11. 26 ÷ 3.	28. 22 ÷ 4.	45. 48 ÷ 7.
12. 84 ÷ 9.	29. 74 ÷ 8.	46. 33 ÷ 8.
13. 28 ÷ 8.	30. 65 ÷ 9.	47. 19 ÷ 9.
14. 49 ÷ 5.	31. 47 ÷ 8.	48. 27 ÷ 4.
15. 28 ÷ 9.	32. 29 ÷ 5.	49. 58 ÷ 6.
16. 37 ÷ 9.	33. 45 ÷ 8.	50. 29 ÷ 9.
17. 32 ÷ 5.	34. 25 ÷ 3.	51. 46 ÷ 8.
18. 59 ÷ 7.	35. 69 ÷ 8.	52. 45 ÷ 7.

SPEED TEST CHART IN SHORT DIVISION

See how many of the following results, including the remainders, you can state in 1 min. If you make a mistake, let your neighbor take up the work:

1. $2 \div 7$.	21. $3 \div 9$.	41. $1 \div 6$.
2. $1 \div 8$.	22. $5 \div 8$.	42. $23 \div 9$.
3. $4 \div 7$.	23. $22 \div 6$.	43. $62 \div 9$.
4. $12 \div 7$.	24. $44 \div 9$.	44. $52 \div 7$.
5. $15 \div 8$.	25. $23 \div 6$.	45. $50 \div 8$.
6. $15 \div 9$.	26. $31 \div 7$.	46. $51 \div 8$.
7. $30 \div 9$.	27. $60 \div 7$.	47. $71 \div 8$.
8. $41 \div 6$.	28. $32 \div 9$.	48. $62 \div 7$.
9. $14 \div 9$.	29. $60 \div 9$.	49. $53 \div 8$.
10. $31 \div 4$.	30. $20 \div 9$.	50. $71 \div 9$.
11. $11 \div 7$.	31. $53 \div 6$.	51. $55 \div 8$.
12. $26 \div 9$.	32. $31 \div 8$.	52. $40 \div 9$.
13. $61 \div 8$.	33. $30 \div 7$.	53. $55 \div 7$.
14. $25 \div 9$.	34. $52 \div 6$.	54. $41 \div 9$.
15. $51 \div 9$.	35. $40 \div 6$.	55. $34 \div 7$.
16. $33 \div 7$.	36. $35 \div 9$.	56. $52 \div 8$.
17. $50 \div 9$.	37. $34 \div 9$.	57. $40 \div 7$.
18. $13 \div 8$.	38. $43 \div 9$.	58. $41 \div 7$.
19. $70 \div 9$.	39. $32 \div 7$.	59. $22 \div 6$.
20. $23 \div 8$.	40. $54 \div 7$.	60. $21 \div 9$.



Taking Parts of Numbers. We know that $\frac{1}{2}$ of a number is one of its two equal parts. Hence in finding $\frac{1}{2}$ of a group of 6 boys we have $\frac{1}{2}$ of 6 is $6 \div 2$, or 3. Similarly,

$\frac{1}{3}$ of 6 is $6 \div 3$, or 2 — $\frac{1}{5}$ of 25 is $25 \div 5$, or 5

$\frac{1}{4}$ of 12 is $12 \div 4$, or 3 — $\frac{1}{8}$ of 48 is $48 \div 8$, or 6

Later we shall review other parts, such as $\frac{3}{4}$ of 48.

PARTS OF NUMBERS

See how many of these parts you can state in 1 min. If you make a mistake, let your neighbor take up the work:

1. $\frac{1}{2}$ of 8.	**10.** $\frac{1}{4}$ of 36.	**19.** $\frac{1}{3}$ of 27.	**28.** $\frac{1}{8}$ of 72.
2. $\frac{1}{4}$ of 8.	**11.** $\frac{1}{8}$ of 80.	**20.** $\frac{1}{5}$ of 25.	**29.** $\frac{1}{4}$ of 32.
3. $\frac{1}{8}$ of 8.	**12.** $\frac{1}{2}$ of 10.	**21.** $\frac{1}{8}$ of 56.	**30.** $\frac{1}{5}$ of 55.
4. $\frac{1}{3}$ of 9.	**13.** $\frac{1}{4}$ of 12.	**22.** $\frac{1}{4}$ of 16.	**31.** $\frac{1}{3}$ of 15.
5. $\frac{1}{5}$ of 15.	**14.** $\frac{1}{8}$ of 16.	**23.** $\frac{1}{3}$ of 12.	**32.** $\frac{1}{9}$ of 27.
6. $\frac{1}{4}$ of 24.	**15.** $\frac{1}{8}$ of 48.	**24.** $\frac{1}{2}$ of 12.	**33.** $\frac{1}{4}$ of 20.
7. $\frac{1}{2}$ of 16.	**16.** $\frac{1}{3}$ of 21.	**25.** $\frac{1}{8}$ of 64.	**34.** $\frac{1}{7}$ of 21.
8. $\frac{1}{3}$ of 18.	**17.** $\frac{1}{4}$ of 28.	**26.** $\frac{1}{8}$ of 24.	**35.** $\frac{1}{2}$ of 22.
9. $\frac{1}{8}$ of 40.	**18.** $\frac{1}{2}$ of 18.	**27.** $\frac{1}{3}$ of 24.	**36.** $\frac{1}{8}$ of 32.

A SILENT READING LESSON

We can often save work, when dividing whole numbers by 10, by powers of 10, or by multiples of these powers, if we take short cuts like the following:

To divide by 10, cut off the right-hand figure of the number divided, taking the figure cut off as the remainder.

For example, in the case of 1430 ÷ 10 we have $143\cancel{0}$, and so the result is 143. In 2637 ÷ 10 we have $263\cancel{7}$, and so the result is 263 with a remainder of 7. We may write this as $263\frac{7}{10}$.

To divide by any power of 10, cut off as many figures from the right of the number divided as there are zeros at the right of the number by which you divide, taking the figures cut off as the remainder.

For example, in 14,600 ÷ 100, we have $14{,}6\cancel{0}\cancel{0}$, and so the result is 146. In 14629 ÷ 1000, we have $14\cancel{6}\cancel{2}\cancel{9}$, and so the result is 14 with a remainder of 629, or $14\frac{629}{1000}$.

To divide by any multiple of 10, 100, and so on, proceed as shown in the following examples:

$$\begin{array}{r} 1230 \\ 3\cancel{0})\overline{3690\cancel{0}} \end{array} \qquad \begin{array}{r} 123 \\ 3\cancel{0}\cancel{0})\overline{369\cancel{0}\cancel{0}} \end{array} \qquad \begin{array}{r} 123\frac{13}{300} \\ 3\cancel{0}\cancel{0})\overline{369\cancel{1}\cancel{3}} \end{array}$$

$$\begin{array}{r} 19 \\ 17\cancel{0})\overline{323\cancel{0}} \\ \underline{17} \\ 153 \\ \underline{153} \end{array} \qquad \begin{array}{r} 19\frac{13}{1700} \\ 17\cancel{0}\cancel{0})\overline{323\cancel{1}\cancel{3}} \\ \underline{17} \\ 153 \\ \underline{153} \\ 13 \end{array} \qquad \begin{array}{r} 9\frac{37}{170} \\ 17\cancel{0})\overline{156\cancel{7}} \\ \underline{153} \\ 37 \end{array}$$

PROBLEMS IN DIVISION

1. At \$60 each, how many radio sets must a manufacturer sell in order to receive \$1860?

2. A dealer sells some city lots at \$900 a lot. If he receives \$53,100 in all, how many lots does he sell?

3. A farmer spends \$6880 in buying cows. At \$80 apiece, how many cows can he buy for this amount?

4. An orange grower has 8460 oranges which he wishes to pack in boxes holding 100 oranges each. How many boxes can he pack, and how many oranges will be left over?

5. If a coal pocket contains 786,400 lb. of coal, how many tons (2000 lb.) does it contain, and how much over?

6. A dealer has \$3850 with which to buy some village lots at \$600 each. What is the greatest number that he can buy, and how much money will he have left?

7. An automobile dealer has \$85,000 to invest in automobiles at \$2000 each. What is the greatest number that he can buy, and how much money will he have left?

Divide as indicated:

8. $400 \div 20$.	11. $37{,}800 \div 200$.	14. $438{,}000 \div 3000$.
9. $900 \div 30$.	12. $54{,}300 \div 300$.	15. $229{,}000 \div 4000$.
10. $700 \div 70$.	13. $92{,}400 \div 400$.	16. $745{,}500 \div 5000$.

17. In laying a floor in a corridor 80 ft. long a carpenter uses boards 16 ft. long. There are 18 boards in the width of the corridor. Allowing for the loss of one board in matching, how many boards does it take?

A SILENT READING LESSON

Read, filling in the blanks as you read:

Edward and John sell newspapers. They keep account of their sales and find that they sell 49,820 papers in a year. Allowing 52 wk. to the year, what is the average number of papers sold per week? To answer this question we see that we must —— 49,820 by 52.

$$\begin{array}{r} 958 \\ 52\overline{)49820} \\ \underline{468} \\ 302 \\ \underline{260} \\ 420 \\ \underline{416} \\ 4 \end{array}$$

To find the first figure in the result we —— 49 by 5. The result is —— with a remainder.

The figure 9 is all right, because 9×52 is ——, and this is less than 498. If it had been greater than 498, we should have tried ——.

We write the 9 over the figure ——, because we are first dividing 498 by 52.

We —— 468 from ——, write the remainder 30 below, and after 30 we write the figure ——, which we bring down from the number that we are dividing.

We continue to divide in the same way and find that the result is $958\frac{4}{52}$.

It would not mean much in such a case to say that the boys sell $958\frac{4}{52}$ newspapers each week. We therefore disregard the small remainder 4 and say that the average number sold per week is ——.

We check the accuracy of our work like this:

$$52 \times 958 = 49{,}816$$

and $$49{,}816 + 4 = \text{——}.$$

DRILL CHART IN LONG DIVISION

Perform the following very easy divisions:

1. 882 ÷ 21.	6. 1924 ÷ 52.	11. 1419 ÷ 33.
2. 744 ÷ 31.	7. 2976 ÷ 62.	12. 2838 ÷ 43.
3. 1558 ÷ 41.	8. 4032 ÷ 72.	13. 4851 ÷ 63.
4. 2142 ÷ 51.	9. 6724 ÷ 82.	14. 2701 ÷ 73.
5. 4686 ÷ 71.	10. 6900 ÷ 92.	15. 9207 ÷ 93.

Perform these harder divisions:

16. 957 ÷ 29.	21. 5372 ÷ 79.	26. 7744 ÷ 88.
17. 1638 ÷ 39.	22. 8722 ÷ 89.	27. 8722 ÷ 98.
18. 2597 ÷ 49.	23. 1596 ÷ 38.	28. 6396 ÷ 78.
19. 4248 ÷ 59.	24. 4466 ÷ 58.	29. 2376 ÷ 36.
20. 2553 ÷ 69.	25. 5372 ÷ 68.	30. 1406 ÷ 37.

Try these, which are still harder:

31. 2070 ÷ 45.	35. 2730 ÷ 78.	39. 7990 ÷ 85.
32. 4140 ÷ 46.	36. 3472 ÷ 28.	40. 5776 ÷ 76.
33. 3472 ÷ 56.	37. 3476 ÷ 44.	41. 7569 ÷ 87.
34. 8280 ÷ 23.	38. 4984 ÷ 56.	42. 9801 ÷ 99.

Now try these, where there are some remainders:

43. 5402 ÷ 69.	46. 4381 ÷ 95.	49. 4375 ÷ 76.
44. 7353 ÷ 68.	47. 3107 ÷ 79.	50. 8291 ÷ 78.
45. 7040 ÷ 64.	48. 6234 ÷ 87.	51. 6007 ÷ 19.

A SILENT READING LESSON

Tom's uncle is a harness manufacturer. If he sells 372 harnesses and receives \$21,375.12 in payment, at what price does he sell each harness? To answer this, we must divide \$21,375.12 by 372.

Stated briefly, we have

$2137 \div 372 = 5$, with a remainder;

The 5 goes over the 7, because we are first dividing 2137. Then

$2775 \div 372 = 7$, with a remainder;
$1711 \div 372 = 4$, with a remainder;
$2232 \div 372 = 6$, with no remainder.

$$\begin{array}{r}
\$57.46 \\
372\overline{)\$21375.12} \\
\underline{1860} \\
2775 \\
\underline{2604} \\
1711 \\
\underline{1488} \\
2232 \\
\underline{2232}
\end{array}$$

We place the decimal point in the result above the decimal point in the number divided.

The result is \$57.46; that is, the price at which Tom's uncle sells each harness is \$57.46.

Check. $372 \times \$57.46 = \$21,375.12.$

As another example, suppose that a mill sells 25 yd. of cloth for \$136. What price per yard does the mill receive for the cloth?

We can find the price per yard by dividing \$136 by 25.

In order to do this, we first write \$136 as \$136.00 and then divide as explained above, finding that

$$\$136.00 \div 25 = \$5.44;$$

that is, the price of the cloth per yard is \$5.44.

PROBLEMS IN DIVISION

Perform the following divisions:

1. $974.58 ÷ 111.	4. $296 ÷ 40.	7. $2992.80 ÷ 27.
2. $772.12 ÷ 199.	5. $128 ÷ 25.	8. $1059.20 ÷ 64.
3. $3867.50 ÷ 25.	6. $385 ÷ 25.	9. $6784.56 ÷ 81.

10. A class of 12 pupils bought an electric postcard projector for the schoolroom. If the projector cost $7.80, what was the share of each pupil?

11. Three boys together buy a small electric motor for $4.47. What is the share that each boy pays?

12. A class of 16 girls bought a slide for the school playground. If the girls paid $13.60 for the slide and 64¢ for express, how much was the share of each?

Copy the following table, filling in the blank spaces:

	NUMBER DIVIDED	DIVIDED BY	RESULT
13.	840	——	64, remainder 8
14.	——	12	$3.67, remainder 7¢
15.	$17.35	144	$——, remainder——
16.	——	79	$13.80, remainder 10¢
17.	3867	——	143, remainder 6

18. A factory ships 60,000 cans of fruit in boxes which hold 4 doz. cans each. How many boxes are required?

19. A cubic yard contains 27 cu. ft. How many cubic yards of earth does a contractor remove in excavating 135,675 cu. ft. of earth?

DRILL CHART IN ESTIMATING ANSWERS

One of the best checks upon foolish errors, such as no one ought ever to make, is to estimate the result in advance. In each of these cases tell which estimate is probably the nearest to the result. Then do the example and see if the one you chose was the nearest:

Operations	Estimates		
1. $7 \times \$1.43$	$1001	$70	$10
2. $21 \times \$14.30$	$28	$30	$303
3. $3 \times 37{,}037$	99,000	111,000	121,000
4. $25 \times 48¢$	$11.50	$12	$12.50
5. $50 \times 75¢$	$3.50	$35.50	$37.50
6. $100 \times \$2.75$	$27.50	$275	$2750
7. $\frac{1}{10}$ of $375	$3.75	$37.50	$3750
8. $\frac{1}{10}$ of $2750	$27.50	$275	$2750
9. $\frac{1}{20}$ of $1500	$3000	$30,000	$75
10. $\$375 \div 25$	$1500	$1.50	$15
11. $\$48.50 \div 25$	$1.50	$1.90	$20
12. $\$151.50 \div 75$	$202	$2	$20
13. $\$38.44 \div 62$	$6.25	$0.60	$62
14. $\$27.01 \div 73$	$37	$0.37	$3.75
15. $\$521.16 \div 43$	$12	$121	$12,120
16. $\$826.50 \div 58$	$1.50	$150	$14

DRILL CHART IN ESTIMATING ANSWERS

Write your estimated results at once; then divide rapidly, and see how close your estimates were:

1. 176 ÷ 11.	11. 900 ÷ 18.	21. 528 ÷ 22.
2. 192 ÷ 12.	12. 513 ÷ 19.	22. 572 ÷ 26.
3. 221 ÷ 13.	13. 462 ÷ 21.	23. 682 ÷ 11.
4. 247 ÷ 13.	14. 700 ÷ 25.	24. 576 ÷ 12.
5. 294 ÷ 14.	15. 800 ÷ 32.	25. 700 ÷ 28.
6. 330 ÷ 15.	16. 625 ÷ 25.	26. 825 ÷ 33.
7. 368 ÷ 16.	17. 506 ÷ 22.	27. 528 ÷ 24.
8. 450 ÷ 18.	18. 544 ÷ 16.	28. 900 ÷ 25.
9. 368 ÷ 23.	19. 572 ÷ 22.	29. 400 ÷ 16.
10. 408 ÷ 17.	20. 682 ÷ 31.	30. 850 ÷ 34.

In the following cases (only some of which are cases in exact division), write your estimate of the whole number in each result; then divide, and see how near you were:

31. 176 ÷ 16.	39. 150 ÷ 24.	47. 500 ÷ 50.
32. 194 ÷ 16.	40. 400 ÷ 30.	48. 500 ÷ 25.
33. 335 ÷ 22.	41. 222 ÷ 22.	49. 500 ÷ 125.
34. 234 ÷ 17.	42. 322 ÷ 22.	50. 750 ÷ 225.
35. 352 ÷ 22.	43. 322 ÷ 16.	51. 750 ÷ 250.
36. 460 ÷ 25.	44. 156 ÷ 32.	52. 700 ÷ 350.
37. 470 ÷ 22.	45. 270 ÷ 27.	53. 725 ÷ 225.
38. 130 ÷ 11.	46. 270 ÷ 81.	54. 775 ÷ 225.

USING WHAT YOU HAVE LEARNED

1. A builder paid 24 men, all at the same rate, $2520 for 15 da. of work. Find each man's daily wage.

2. At the same price for each set, a furniture dealer sold 4 sets of dining-room furniture each week for 3 wk. If his total receipts were $852, what was the price of each set?

3. A dealer paid $1152 for 3 doz. suits of clothes, all at the same price. How much did he pay for each suit?

4. A company has 175 men in one of its departments, all of whom receive the same wages. If in 5 da. the pay roll amounts to $5250, what are the daily wages of each man?

5. Another department in Ex. 4 has 210 men, all receiving the same wages. If in 5 da. the pay roll amounts to $7087.50, what are the daily wages of each man?

6. In a school which has 44 pupils the teacher's salary is $1500 a year. The cost of fuel is $144.20; of books and other school supplies, $172.80; of repairs and improvements, $75. Find the total cost per pupil for the year.

7. For a month in which he used 6000 cu. ft. of gas a man's gas bill was $6.60. Find the cost per 1000 cu. ft.

8. A class of 24 pupils bought these toys for a children's hospital, sharing the cost equally: an automobile for $8, a cart for $7, a building set for $9, a train for $6, a stove for $5, some blocks for $1. What was each pupil's share?

9. A merchant found that in one month he paid $30 for light, $382 for wages, $220 for rent, and $70 for other expenses. If there were 26 business days in that month, how much were the average expenses per business day?

10. A dealer pays \$413.56 for 14 suits of ready-made clothes. First estimate how much he pays per suit, and then find the exact result. At the same rate, how much would he pay for 7 suits? for 28 suits?

11. If 27 A. of land are worth \$2227.50, what is the average value per acre? How much are 4 A. worth?

12. A man pays \$1430 for the rent of an apartment in the city for 11 mo. At this rate, how much does he pay for 1 mo.? for 5 mo.? for 7 mo.? for 3 mo.? for 8 mo.?

13. The letter M is the Roman numeral for thousand, and C for hundred. Hence 7 M means 7000, and \$8.75 per C means \$8.75 per hundred. Lumber is usually sold by the 1000 ft. A man bought 8 M ft. of lumber at \$48.50 per M. He sold half of it at \$8.75 per C, and the other half at \$47.50 per M. How much did he gain?

14. At an athletic meet 860 spectators bought tickets at 45¢ each, and 1240 at 25¢ each. What was the average amount to the nearest cent paid by each spectator?

15. A builder made a profit of \$865 on one house, \$540 on a second, \$690 on a third, and lost \$275 on a fourth. What was his average profit per house?

16. At 60 lb. to the bushel, how many bushels are there in a shipment of 28,750 lb. of wheat, and how many pounds are left over?

17. A farm bulletin states that the corn raised on an acre of good land should contain 147 lb. of fat, which is one of the food elements in corn. How many such acres are needed to produce 5586 lb. of fat?

DRILL CHART IN LONG DIVISION

Perform the following divisions:

1. 85,785 ÷ 301.
2. 59,314 ÷ 631.
3. 48,594 ÷ 623.
4. 364,397 ÷ 211.
5. 976,950 ÷ 501.
6. 972,471 ÷ 111.
7. 161,784 ÷ 321.
8. 324,360 ÷ 306.
9. 140,850 ÷ 225.
10. 183,750 ÷ 175.
11. 148,555 ÷ 407.
12. 234,901 ÷ 503.
13. 208,575 ÷ 309.
14. 870,672 ÷ 204.
15. $3678.48 ÷ 786.
16. $1024.65 ÷ 495.
17. $4729.32 ÷ 604.
18. $3492.06 ÷ 407.
19. $1174.40 ÷ 320.
20. $4196.40 ÷ 538.
21. $2877.12 ÷ 216.
22. 51,716 ÷ 14.
23. 45,952 ÷ 16.
24. 85,635 ÷ 22.
25. 54,268 ÷ 37.
26. 92,357 ÷ 28.
27. 36,452 ÷ 49.
28. 88,757 ÷ 56.
29. 41,795 ÷ 56.
30. 79,145 ÷ 49.
31. 36,523 ÷ 48.
32. 67,558 ÷ 59.
33. 87,073 ÷ 66.
34. 90,601 ÷ 72.
35. 401,121 ÷ 332.
36. 210,379 ÷ 224.
37. 852,191 ÷ 315.
38. 720,830 ÷ 853.
39. 360,389 ÷ 427.
40. 692,823 ÷ 236.
41. 811,423 ÷ 2878.
42. 487,712 ÷ 4327.

DRILL CHART IN LONG DIVISION

After each of these examples are four possible results, one of which is right. Copy the examples, picking out and writing the correct result after each one:

1. 9641 ÷ 31; 101, 331, 116, or 311.
2. 29,568 ÷ 176; 108, 168, 193, or 226.
3. 12,705 ÷ 231; 505, 425, 314, or 55.
4. 17,625 ÷ 125; 125, 141, 145, or 245.
5. 42,625 ÷ 341; 145, 105, 215, or 125.
6. 47,840 ÷ 260; 199, 184, 176, or 146.
7. 51,968 ÷ 224; 232, 242, 286, or 176.
8. 77,720 ÷ 670; 126, 106, 116, or 249.

Some of the following results are right and some are wrong. Copy the statements, and divide, writing + after those which are correct and the correct result after those which are wrong:

9. 85,407 ÷ 343 = 249.
10. 76,010 ÷ 151 = 503, remainder 50.
11. 76,111 ÷ 608 = 125, remainder 111.
12. 53,165 ÷ 217 = 255; or 245, remainder 8.
13. 52,900 ÷ 116 = 456, remainder 4.
14. 85,250 ÷ 250 = 342.
15. 28,750 ÷ 1250 = 231, remainder 2.
16. 175,098 ÷ 758 = 231.
17. 162,842 ÷ 118 = 138, remainder 2.

REVIEW PROBLEMS

1. A garage owner received the following amounts from the sale of gasoline: Monday, \$75.85; Tuesday, \$146.20; Wednesday, \$155.85; Thursday, \$180.40; Friday, \$190.50; Saturday, \$248.60. Find the total amount for the week.

2. The owner of an automobile bought the following items: tires, \$57.60; inner tubes, \$16.50; oil, \$1.80; tire chains, \$6.50; gasoline, \$5.60. What was the total amount of the bill?

3. Last week the daily sales in a grocery store were as follows: Monday, \$460.20; Tuesday, \$720.83; Wednesday, \$652.56; Thursday, \$760.54; Friday, \$530.28; Saturday, \$1062.49. What was the total amount of the sales for the week?

4. On the first day of last month Mr. Brown paid the following bills: gas, \$4.40; electricity, \$3.56; groceries, \$33.65; meat, \$15.40; laundry, \$16.20; telephone, \$4.50; milk, \$12.60. What was the total amount paid?

5. Mr. Morris bought a camping outfit, which included the following articles: tent, \$48.60; blankets, \$23.50; air mattresses, \$36.80; air pillows, \$3.00; gasoline stove, \$7.50; cooking utensils, \$14.50; miscellaneous, \$13.40. Find the total cost.

6. A town school department paid the following amounts for coal: September, \$118.75; October, \$106.38; November, \$149.50; December, \$133.60; January, \$165.70; February, \$162.80; March, \$143.60; April, \$105.13; May, \$100.59. Find the total amount of the coal bill.

REVIEW PROBLEMS

1. At 56¢ each, how much will it cost to buy arithmetic books for 347 pupils?

2. How much do 13 T. of coal cost at $14.25 a ton?

3. A farmer in northern Maine sold 1750 bu. of potatoes at 65¢ a bushel. How much did he receive?

4. We bought 107 yd. of material at $4.75 a yard to make a curtain for our school auditorium. Find the cost.

5. The children in our school used 497 qt. of milk last week at a cost of 16¢ a quart. Find the cost.

6. A farmer sold 96 doz. eggs at 65¢ a dozen. How much did he receive for the eggs?

7. How much is the cost of 21,000 cu. ft. of gas at $1.25 per 1000 cu. ft.?

8. A fruit grower in New Jersey sold 785 barrels of apples at $4.50 a barrel. How much did he receive?

9. We burned 297 T. of coal last year in School No. 3. At $6.80 a ton, how much was the coal bill?

10. In School No. 7 natural gas is used for heating. Last winter 1,670,000 cu. ft. of gas were consumed. How much was the gas bill at 45¢ per 1000 cu. ft.?

11. A shop which builds locomotives employed 3457 men during the first week in July. The average weekly wage paid to each man was $26.40. How much was the total pay roll for the week?

12. A school board paid 85¢ an hour for 358 hr. of labor for painting the school building. Find the total cost.

REVIEW PROBLEMS

1. A potato dealer loaded a freight car with 34,320 lb. of potatoes. At 60 lb. of potatoes to the bushel, how many bushels did he put in the car?

2. When the high-school building in a western town was destroyed by fire, the insurance company paid the town $80,000. How much more money must be raised to build a new school costing $250,000?

3. We had a school picnic last spring on the shore of a lake. We spent $101.21 for the food. How much did it cost each of the 349 persons at the picnic?

4. An express train makes a run of 441 mi. in 9 hr., including all stops. What is the average distance the train covers in an hour?

5. Last summer, on a trip from Chicago to New York and return, we drove our car 2664 mi., and used 148 gal. of gasoline. How many miles did we average per gallon?

6. We paid $32.56 for the 148 gal. of gasoline we used on the trip mentioned in Ex. 5. What was the average price per gallon?

7. In 1890 there were 297,894 pupils enrolled in the high schools of the United States. In 1920 there were 2,041,308 enrolled. What was the increase?

8. Some years ago it cost an eastern city $209,547.93 to run the high schools. Eleven years later, owing to the increase in attendance and to the improvement in the schools, it cost $1,020,844.23. How much was the increase in cost during this time?

II. FRACTIONS

A SILENT READING LESSON

Read, filling in the blanks as you read:

The number 3 is a whole ——, but $\frac{3}{4}$ is a ——.

In the fraction $\frac{3}{4}$, the *numerator* is ——, and the *denominator* is ——.

The *terms* of the fraction $\frac{3}{4}$ are —— and ——.

A quarter of a dollar is a fraction of a dollar, but is usually written as \$0.25. This shows that fractions are sometimes written without writing the denominators.

The common way of writing three fourths is $\frac{3}{4}$. Such a fraction is called a *common fraction*, or, more often, it is called simply a *fraction*.

If the numerator of a fraction is 1, we call the fraction a *unit* ——.

A fraction like $\frac{3}{4}$, in which the numerator is less than the ——, is called a *proper fraction.*

A fraction like $\frac{2}{2}$ or $\frac{3}{2}$, in which the —— is equal to or greater than the denominator, is called an *improper* ——.

A number like $3\frac{3}{4}$ is called a *mixed number*. The numbers ——, ——, and —— are mixed numbers.

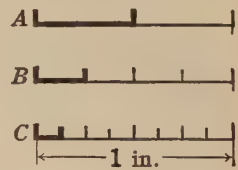
The *factors* of 6 are 2 and 3; that is, when the factors 3 and 2 are multiplied together, the result is ——.

A factor of each of two numbers is called a *common factor* of the numbers. For example, 2 is a common factor of 6 and 12, and it is also a common factor of —— and ——.

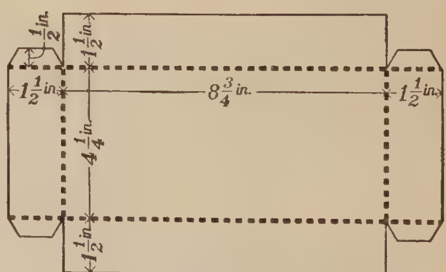
A number which has no factors except 1 and itself is called a *prime number*. For example, 7 and —— are —— numbers.

FRACTIONS IN MEASURING

1. Most rulers used in schools are divided into fractions of an inch. These fractions are often halves, fourths, and eighths. Rulers used in practical work are divided into inches, sixteenths, thirty-seconds, and sometimes sixty-fourths. Other rulers are divided into tenths of an inch. We rarely use other fractions of an inch, such as thirds, sixths, twelfths, and so on. The lines *A*, *B*, and *C* here shown are each 1 in. long. Which one is divided into fourths? into eighths? into halves?



2. A set of directions for making a box told the pupils to cut a piece of cardboard $11\frac{3}{4}$ in. long and $7\frac{1}{4}$ in. wide; to draw the lines and cut out corners as shown in this figure; and then, by folding along the heavy dotted lines and pasting the four flaps, to complete the box. Make a pattern for such a box.



3. The directions for making the cover for the box were the same as those in Ex. 2, except that the measurements of the top were $4\frac{3}{8}$ in. instead of $4\frac{1}{4}$ in. and $8\frac{7}{8}$ in. instead of $8\frac{3}{4}$ in., and the width for the side pieces was $\frac{1}{2}$ in. instead of $1\frac{1}{2}$ in. Make a pattern for such a cover and show how it is to be folded.

A SILENT READING LESSON

We see as we look at this circle that there are 6 sixths of a circle in the whole circle. It makes us think of the number of sixths in a whole pie.

In half a pie we see that there are 3 sixths. We thus see that $\frac{1}{2}$ and $\frac{3}{6}$ are equal. When we write $\frac{3}{6}$ instead of $\frac{1}{2}$, we simply change the name of the fraction.

This rectangle has been divided into eight equal squares, each of which is $\frac{1}{8}$ of the rectangle. If we call a square

"one," we must call the rectangle "eight"; but if we call the rectangle "one," then we must call a square "one eighth."

As we look at this circle we see that there are 4 eighths in half the circle. If we should cut a pie into eighths, there would be 4 eighths in half of it.

As we look at this circle we see that there are 6 eighths in $\frac{3}{4}$ of a pie. This shows us that $\frac{3}{4}$ and $\frac{6}{8}$ are equal, although one of the fractions is called fourths and the other is called eighths.

This circle shows us how many tenths there are in a half. When we write $\frac{1}{2}$ and $\frac{5}{10}$, we know that they are equal, although one of the fractions is called a half and the other is called five tenths.

This circle shows us that $\frac{4}{5}$ and $\frac{8}{10}$ are equal, although they have different names; that is, one fraction is called fifths and the other tenths.

Thus, from the examples given above, we see that

$$\tfrac{1}{2}=\tfrac{3}{6},\ \tfrac{1}{2}=\tfrac{4}{8},\ \tfrac{1}{2}=\tfrac{5}{10},\ \tfrac{3}{4}=\tfrac{6}{8},\text{ and }\tfrac{4}{5}=\tfrac{8}{10}.$$

A LITTLE WRITING LESSON

Copy the following and complete the sentences which are left unfinished, making drawings when needed:

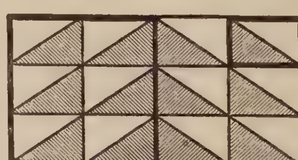
1. Although the denominator of $\frac{1}{2}$ is less than that of $\frac{1}{4}$, the fraction $\frac{1}{2}$ is greater than $\frac{1}{4}$. These drawings (make them) show that $\frac{1}{2}$ is —— than $\frac{1}{3}$, that $\frac{1}{4}$ is —— than $\frac{1}{3}$, and that $\frac{1}{2} = \frac{2}{4}$.

2. This diagram shows something about fractions. The heavy lines, for example, show that $\frac{3}{6} =$ ——. The diagram shows also that $\frac{1}{3}$ of the rectangle has —— small squares and that —— of the rectangle has 3 small squares; that is, —— is less than ——.

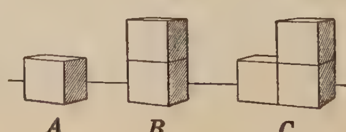
3. This diagram shows that $\frac{1}{3}$ is equal to —— sixths, that $\frac{1}{3}$ is —— than $\frac{1}{2}$, and that $\frac{4}{6}$, or $\frac{2}{3}$, is —— than $\frac{1}{2}$.

4. This diagram shows that $\frac{5}{6}$ is —— than $\frac{1}{2}$ and that $\frac{5}{6} = \frac{2}{3} +$ ——.

5. In this rectangle there are —— smaller rectangles and —— small triangles. They show that $\frac{2}{24}$ is equal to —— twelfth, and that $\frac{6}{12}$ is equal to —— half.



6. In this picture, block *A* is —— as large as block *B* and —— as large as block *C*. Similarly, block *B* is —— as large as block *C*.



A SILENT READING LESSON

From the examples on pages 61 and 62, we see that

Both terms of a fraction may be multiplied by the same number without changing the value of the fraction.

Both terms of a fraction may be divided by the same number without changing the value of the fraction.

When we change the terms of a fraction without changing the value of the fraction, we *reduce* the fraction.

For example, when we say that $\frac{1}{2} = \frac{2}{4}$, we change $\frac{1}{2}$ to fourths; or, as is commonly said, we reduce $\frac{1}{2}$ to fourths.

When both terms cannot be divided exactly by the same number, the fraction is said to be *in lowest terms,* or to be *reduced to lowest terms.*

For example, $\frac{44}{48}$ is in lowest terms when reduced to $\frac{11}{12}$.

In making a small airplane Frank found that he must use $\frac{8}{12}$ of a piece of wire. This seemed to him an awkward fraction to use. When he looked at the fraction, he saw that the largest factor of 8 and 12 is 4. He then wrote

$$\frac{8}{12} = \frac{8 \div 4}{12 \div 4} = \frac{2}{3}, \text{ in lowest terms.}$$

$$\boxed{\frac{\overset{2}{\cancel{8}}}{\underset{3}{\cancel{12}}} = \frac{2}{3}}$$

When the work is written as shown at the right, the factor 4 is said to be *canceled* from both terms.

Frank then wrote this in his notebook:

To reduce a fraction to lowest terms, cancel all factors common to both terms.

We shall see on page 64 that we can tell quickly what factors to try, when numbers like 2, 3, or 5 are factors.

Divisibility of Numbers. When we speak of a number as being "divisible" by another, we mean that it can be divided without a remainder. Learn these cases:

A number is divisible by 2 if the digit in units' place is so divisible.

Thus, 54 is divisible by 2 because 4 is divisible by 2.

A whole number that is divisible by 2 is called an *even number*; one which is not is called an *odd number.*

A number is divisible by 10 if it ends in 0.

Thus, 30, 120, 800, and 5000 are divisible by 10.

A number is divisible by 5 if it ends in 0 or 5.

Thus, 180, 105, and 277,005 are divisible by 5.

Other Cases. These cases need not be memorized:

A number is divisible by 3 if the sum of its digits is so divisible, and by 6 if it is even and if the sum of its digits is divisible by 3.

Thus, 411 is divisible by 3 because $4 + 1 + 1 = 6$, and 1122, but not 1221, is divisible by 6.

A number is divisible by 4 if the number represented by its two right-hand figures is so divisible, and by 8 if the number represented by its three right-hand figures is so divisible.

Thus, we easily see that 9784 is divisible by 4 and that 175,640 is divisible by 8.

A number is divisible by 9 if the sum of its digits is so divisible.

For example, the number 70,812 is divisible by 9 because we have $7 + 0 + 8 + 1 + 2 = 18$.

Cancellation. We do not often compute with such fractions as $\frac{84}{192}$. In dividing 1620 by 192, however, we have the remainder 84, and need to reduce the fraction $\frac{84}{192}$ to lowest terms. To do this we cancel as here shown.

$$\begin{array}{r} 8 \\ 192\overline{)1620} \\ \underline{1536} \\ 84 \end{array} \qquad \frac{\overset{7}{\cancel{84}}}{\underset{16}{\cancel{192}}} = \frac{7}{16}$$

$8\frac{7}{16}$. *Ans.*

In this case we canceled 12 from 84 and 192 at once. You may, if it is easier, cancel first 4 and then 3.

In solving certain kinds of examples, we shall find it convenient to write the work in a fractional form like

$$\frac{3 \times 14 \times 15}{6 \times 35}.$$

Canceling,
$$\frac{\cancel{3} \times \overset{7}{\cancel{14}} \times \overset{3}{\cancel{15}}}{\underset{2}{\cancel{6}} \times \underset{5}{\cancel{35}}} = 3.$$

USING CANCELLATION

Reduce to lowest terms these fractions found in divisions:

1. $\frac{35}{56}$. 3. $\frac{16}{64}$. 5. $\frac{40}{48}$. 7. $\frac{35}{75}$. 9. $\frac{48}{72}$. 11. $\frac{36}{288}$.
2. $\frac{49}{56}$. 4. $\frac{25}{35}$. 6. $\frac{160}{240}$. 8. $\frac{55}{80}$. 10. $\frac{24}{144}$. 12. $\frac{720}{1152}$.

Simplify the following by cancellation:

13. $\frac{9 \times 15}{10 \times 80}$. 15. $\frac{6 \times 11 \times 35}{2 \times 33 \times 40}$. 17. $\frac{6 \times 24 \times 35}{8 \times 15 \times 42}$.

14. $\frac{35 \times 33}{15 \times 112}$. 16. $\frac{5 \times 27 \times 56}{8 \times 15 \times 224}$. 18. $\frac{15 \times 24 \times 63}{18 \times 20 \times 112}$.

REDUCING FRACTIONS

Numbers 1 to 14, oral

1. In these lines how many sixths do you see in $\frac{1}{2}$? in $\frac{2}{2}$? in 1?

2. How many sixths do you see in $\frac{1}{3}$? in $\frac{2}{3}$? in $\frac{3}{3}$? in 1?

Read the following, supplying the missing terms:

3. $\frac{1}{2} = \frac{\ }{8}$. **6.** $\frac{1}{8} = \frac{4}{\ }$. **9.** $\frac{5}{8} = \frac{\ }{64}$. **12.** $\frac{3}{16} = \frac{9}{\ }$.
4. $\frac{2}{3} = \frac{\ }{9}$. **7.** $\frac{1}{8} = \frac{5}{\ }$. **10.** $\frac{7}{8} = \frac{\ }{32}$. **13.** $\frac{7}{16} = \frac{28}{\ }$.
5. $\frac{3}{4} = \frac{\ }{16}$. **8.** $\frac{3}{8} = \frac{18}{\ }$. **11.** $\frac{3}{4} = \frac{\ }{64}$. **14.** $\frac{8}{32} = \frac{1}{\ }$.

Reduce the following fractions to halves:

15. $\frac{3}{6}$. **16.** $\frac{2}{4}$. **17.** $\frac{4}{4}$. **18.** $\frac{8}{4}$. **19.** $\frac{12}{4}$. **20.** $\frac{9}{6}$.

Reduce the following fractions to fourths:

21. $\frac{1}{2}$. **22.** $\frac{6}{2}$. **23.** $\frac{18}{8}$. **24.** $\frac{24}{8}$. **25.** $\frac{28}{8}$. **26.** $\frac{32}{8}$.

Reduce the following fractions to eighths:

27. $\frac{3}{4}$. **28.** $\frac{6}{6}$. **29.** $\frac{5}{2}$. **30.** $\frac{14}{4}$. **31.** $\frac{4}{16}$. **32.** $\frac{8}{16}$.

Reduce the following fractions to twelfths:

33. $\frac{1}{3}$. **34.** $\frac{3}{4}$. **35.** $\frac{2}{3}$. **36.** $\frac{7}{6}$. **37.** $\frac{9}{6}$. **38.** $\frac{4}{24}$.

Reduce the following fractions to lowest terms:

39. $\frac{4}{8}$. **40.** $\frac{4}{6}$. **41.** $\frac{3}{9}$. **42.** $\frac{6}{10}$. **43.** $\frac{4}{12}$. **44.** $\frac{6}{15}$.

Simplify the following fractions found in divisions:

45. $\frac{48}{60}$. **47.** $\frac{60}{80}$. **49.** $\frac{72}{144}$. **51.** $\frac{75}{125}$. **53.** $\frac{65}{70}$. **55.** $\frac{55}{99}$.
46. $\frac{72}{104}$. **48.** $\frac{60}{105}$. **50.** $\frac{240}{720}$. **52.** $\frac{111}{123}$. **54.** $\frac{320}{360}$. **56.** $\frac{385}{700}$.

USING WHAT YOU HAVE LEARNED

1. A workman has several sizes of drills, marked $\frac{8}{16}$ in., $\frac{14}{32}$ in., $\frac{3}{8}$ in., $\frac{3}{4}$ in., and $\frac{5}{8}$ in., the fractions showing the diameters (the distances across the ends). By reducing these fractions to thirty-seconds, arrange them in order of size, beginning with the smallest.

2. Mary needs 24 in., or $\frac{24}{36}$ yd., of cloth for some work that she is doing. Reduce this fraction to lowest terms.

3. In measuring an iron rod, Jack found that the diameter was $\frac{14}{16}$ in. Express this in eighths of an inch. Is the diameter less than $\frac{1}{2}$ in.? than $\frac{3}{4}$ in.?

4. A piece of plate glass is $\frac{8}{32}$ in. thick. Express the thickness in eighths of an inch; in sixteenths of an inch. Express $\frac{8}{32}$ in lowest terms.

5. A man ordered some iron strips $\frac{1}{8}$ in. thick and some that were $\frac{5}{32}$ in. thick. Which strips were the thicker?

Reduce the following fractions to sixty-fourths:

6. $\frac{7}{16}$. 7. $\frac{9}{16}$. 8. $\frac{9}{32}$. 9. $\frac{15}{32}$. 10. $\frac{16}{32}$. 11. $\frac{12}{128}$.

Reduce the following fractions to thirty-sixths:

12. $\frac{2}{3}$. 13. $\frac{3}{4}$. 14. $\frac{1}{9}$. 15. $\frac{1}{6}$. 16. $\frac{5}{9}$. 17. $\frac{12}{24}$.

Reduce the following fractions to twenty-fourths:

18. $\frac{7}{12}$. 19. $\frac{1}{3}$. 20. $\frac{2}{48}$. 21. $\frac{6}{48}$. 22. $\frac{5}{12}$. 23. $\frac{11}{12}$.

REDUCING TO AN IMPROPER FRACTION

Numbers 1 to 3, oral

1. How many halves of a circle do you see in 1 circle? in $1\frac{1}{2}$ circles? Express the fraction $\frac{3}{2}$ as a mixed number.

2. How many halves of a circle do you see in 2 circles? in $2\frac{1}{2}$ circles? Express the fraction $\frac{5}{2}$ as a mixed number.

3. How many thirds do you see in 1? in $1\frac{1}{3}$? in $1\frac{2}{3}$? in 2? Express the fractions $\frac{4}{3}$ and $\frac{5}{3}$ as mixed numbers.

4. How many fourths are there in 1? in $1\frac{1}{4}$? in $1\frac{3}{4}$? in 2? Write only the results; that is, $\frac{4}{4}$, $\frac{5}{4}$, and so on.

5. How many fifths are there in 1? in $1\frac{1}{5}$? in $1\frac{2}{5}$?

6. How many sixths are there in 1? in $1\frac{1}{6}$? in $1\frac{5}{6}$? in 2? in $2\frac{1}{6}$? in $2\frac{5}{6}$? in 3?

7. How many sevenths are there in $1\frac{1}{7}$? in $2\frac{2}{7}$? in $3\frac{1}{7}$?

8. How many eighths are there in 1? in 2? in $2\frac{1}{8}$?

9. How many ninths are there in $1\frac{1}{9}$? in $2\frac{2}{9}$? in 3?

10. How many tenths are there in $3\frac{3}{10}$? in $3\frac{7}{10}$? in 4?

11. How many twelfths are there in 1? in 2? in 3? in 4? in $2\frac{1}{12}$? in $3\frac{5}{12}$? in $4\frac{7}{12}$? in $4\frac{11}{12}$?

12. How many sixteenths are there in 1? in 2? in 3? in 4? in $1\frac{1}{16}$? in $1\frac{3}{16}$? in $2\frac{1}{16}$? in $2\frac{5}{16}$? in $3\frac{7}{16}$? in $4\frac{9}{16}$?

Reducing to an Improper Fraction. The Red Cross workers wished to make bandages 1 yd. long and $\frac{1}{8}$ yd. wide. Ruth's mother had a piece of cloth $4\frac{5}{8}$ yd. long and 1 yd. wide, which she cut crosswise into pieces $\frac{1}{8}$ yd. wide and 1 yd. long. How many bandages did she make?

Ruth found the number by reducing $4\frac{5}{8}$ to eighths.

She wrote $$4 = \frac{4 \times 8}{8} = \frac{32}{8},$$

and $$4\tfrac{5}{8} = \tfrac{32}{8} + \tfrac{5}{8} = \tfrac{37}{8}.$$

After finding that $4\frac{5}{8} = \frac{37}{8}$, Ruth gave the answer. How many eighths were there? How many bandages?

REDUCING TO AN IMPROPER FRACTION

1. How many strips of cloth $\frac{1}{4}$ yd. wide can be cut from $7\frac{3}{4}$ yd. of cloth? from $8\frac{1}{4}$ yd.? from $9\frac{3}{4}$ yd.? from $5\frac{1}{2}$ yd.?

2. How many packages of pepper, each weighing $\frac{1}{8}$ lb., can be put up from $3\frac{3}{8}$ lb. of pepper? from $4\frac{7}{8}$ lb.?

Reduce the following numbers as indicated:

3. 2 to eighths.
4. 3 to thirds.
5. $1\frac{1}{2}$ to halves.
6. $3\frac{4}{5}$ to fifths.
7. $3\frac{2}{3}$ to thirds.
8. $4\frac{5}{6}$ to sixths.
9. $3\frac{1}{9}$ to ninths.
10. $2\frac{3}{5}$ to fifths.
11. $3\frac{1}{3}$ to thirds.
12. $4\frac{2}{5}$ to fifths.
13. $5\frac{4}{9}$ to ninths.
14. $6\frac{3}{5}$ to fifths.
15. $7\frac{2}{3}$ to thirds.
16. $8\frac{5}{9}$ to ninths.
17. $3\frac{2}{9}$ to ninths.
18. 32 to tenths.
19. $3\frac{1}{4}$ to fourths.
20. $6\frac{5}{8}$ to eighths.
21. $4\frac{3}{4}$ to fourths.
22. $5\frac{1}{8}$ to eighths.
23. $6\frac{7}{8}$ to eighths.
24. $9\frac{1}{6}$ to sixths.
25. 64 to halves.
26. $6\frac{3}{5}$ to fifths.

Reducing to Whole or Mixed Numbers. Edward sold tickets for an athletic meet. When he came to count his money, he found that he had 78 quarters. How many dollars were these quarters worth?

Edward saw that he must reduce $\frac{78}{4}$ to dollars; that is, to a whole number or a mixed number. He therefore wrote

$$\frac{78}{4} = 78 \div 4 = 19\frac{2}{4} = 19\frac{1}{2}.$$

That is, the 78 quarters were worth $\$19\frac{1}{2}$, or \$19.50.

Read, but do not memorize these statements:

A fraction is an indicated division.

To reduce an improper fraction to a whole number or a mixed number, divide the numerator by the denominator and express the result in lowest terms.

REDUCING TO WHOLE OR MIXED NUMBERS

Numbers 1 and 2, oral

1. Theresa earned 14 half dollars by taking care of a neighbor's baby. How many dollars was this?

2. In collecting for the football team, James took in 32 quarters. How many dollars did he collect?

Reduce the following fractions to whole or to mixed numbers:

3. $\frac{4}{2}$.	**7.** $\frac{10}{2}$.	**11.** $\frac{30}{3}$.	**15.** $\frac{40}{4}$.	**19.** $\frac{33}{3}$.	**23.** $\frac{81}{8}$.
4. $\frac{6}{2}$.	**8.** $\frac{11}{2}$.	**12.** $\frac{30}{6}$.	**16.** $\frac{40}{8}$.	**20.** $\frac{44}{4}$.	**24.** $\frac{92}{12}$.
5. $\frac{8}{2}$.	**9.** $\frac{8}{4}$.	**13.** $\frac{30}{5}$.	**17.** $\frac{40}{3}$.	**21.** $\frac{44}{5}$.	**25.** $\frac{76}{32}$.
6. $\frac{7}{2}$.	**10.** $\frac{9}{4}$.	**14.** $\frac{30}{4}$.	**18.** $\frac{40}{6}$.	**22.** $\frac{44}{8}$.	**26.** $\frac{100}{32}$.

27. Express as dollars: 29 quarters; 31 quarters.

28. Express as dollars: 24 half dollars; 25 half dollars.

ORAL DRILL CHART IN REDUCING FRACTIONS

Express the following fractions as whole numbers or as mixed numbers, reading each row as rapidly as you can:

1.	$\frac{2}{2}$	$\frac{3}{3}$	$\frac{3}{2}$	$\frac{4}{2}$	$\frac{4}{3}$	$\frac{4}{4}$	$\frac{5}{4}$	$\frac{8}{4}$	$\frac{9}{4}$	$\frac{12}{4}$
2.	$\frac{6}{2}$	$\frac{7}{2}$	$\frac{8}{2}$	$\frac{9}{2}$	$\frac{6}{3}$	$\frac{7}{3}$	$\frac{8}{3}$	$\frac{9}{3}$	$\frac{7}{4}$	$\frac{10}{4}$
3.	$\frac{8}{8}$	$\frac{9}{8}$	$\frac{10}{8}$	$\frac{12}{8}$	$\frac{16}{8}$	$\frac{20}{8}$	$\frac{24}{8}$	$\frac{30}{8}$	$\frac{32}{8}$	$\frac{64}{8}$
4.	$\frac{16}{16}$	$\frac{32}{16}$	$\frac{33}{16}$	$\frac{64}{16}$	$\frac{20}{10}$	$\frac{24}{12}$	$\frac{25}{12}$	$\frac{36}{12}$	$\frac{48}{12}$	$\frac{50}{12}$

Express these mixed numbers as improper fractions, reading each row as rapidly as you can:

5.	$1\frac{1}{2}$	$2\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{2}$	$1\frac{1}{3}$	$2\frac{1}{3}$	$5\frac{1}{3}$	$7\frac{1}{3}$
6.	$1\frac{1}{4}$	$1\frac{3}{4}$	$2\frac{1}{4}$	$2\frac{3}{4}$	$3\frac{3}{4}$	$1\frac{1}{8}$	$2\frac{1}{8}$	$3\frac{1}{8}$
7.	$1\frac{3}{8}$	$1\frac{5}{8}$	$1\frac{7}{8}$	$2\frac{3}{8}$	$2\frac{5}{8}$	$2\frac{7}{8}$	$5\frac{1}{8}$	$4\frac{1}{8}$

Read the following, supplying the missing terms:

8. $1 = \frac{}{2}$.	13. $2 = \frac{}{2}$.	18. $5 = \frac{}{2}$.	23. $10 = \frac{20}{}$.
9. $1 = \frac{3}{}$.	14. $2 = \frac{6}{}$.	19. $5 = \frac{15}{}$.	24. $12 = \frac{}{2}$.
10. $1 = \frac{}{4}$.	15. $3 = \frac{}{4}$.	20. $6 = \frac{}{3}$.	25. $16 = \frac{}{2}$.
11. $1 = \frac{}{6}$.	16. $4 = \frac{}{3}$.	21. $7 = \frac{14}{}$.	26. $20 = \frac{}{2}$.
12. $1 = \frac{}{8}$.	17. $4 = \frac{8}{}$.	22. $8 = \frac{24}{}$.	27. $30 = \frac{60}{}$.

Read these fractions, reducing them to lowest terms; that is, to the form most convenient for use:

28.	$\frac{2}{4}$	$\frac{3}{6}$	$\frac{2}{8}$	$\frac{2}{6}$	$\frac{3}{9}$	$\frac{2}{12}$	$\frac{3}{12}$	$\frac{4}{12}$	$\frac{8}{12}$	$\frac{6}{12}$
29.	$\frac{4}{8}$	$\frac{6}{8}$	$\frac{2}{10}$	$\frac{4}{10}$	$\frac{8}{10}$	$\frac{5}{10}$	$\frac{6}{10}$	$\frac{10}{12}$	$\frac{2}{16}$	$\frac{8}{16}$

30. Which is the larger, $\frac{3}{4}$ or $\frac{5}{8}$? $\frac{1}{3}$ or $\frac{1}{2}$? $\frac{2}{3}$ or $\frac{1}{2}$?

MULTIPLYING A NUMERATOR

All work oral

1. Which is greater, \$3 or \$1? How many times as great is it?

2. In this square, $\frac{3}{4}$ of the square is how many times as great as $\frac{1}{4}$ of the square?

3. Multiplying the numerator of $\frac{1}{4}$ by 3 multiplies the fraction by what number?

4. Read and learn this statement:

Multiplying the numerator by any number multiplies the fraction by that number.

5. The shaded part of the above square is what part of the square? $\frac{12}{16}$ is how many times $\frac{1}{16}$? Multiplying the numerator of $\frac{1}{16}$ by 12 does what to the fraction?

In each of these cases state the number by which the numerator of the first fraction was multiplied to make the numerator of the second, and tell what this did to the fraction:

6. $\frac{1}{2}$, $\frac{3}{2}$.
7. $\frac{1}{4}$, $\frac{3}{4}$.
8. $\frac{1}{4}$, $\frac{5}{4}$.
9. $\frac{3}{4}$, $\frac{9}{4}$.
10. $\frac{3}{4}$, $\frac{15}{4}$.
11. $\frac{1}{8}$, $\frac{5}{8}$.
12. $\frac{1}{8}$, $\frac{7}{8}$.
13. $\frac{3}{8}$, $\frac{9}{8}$.
14. $\frac{3}{8}$, $\frac{15}{8}$.
15. $\frac{3}{8}$, $\frac{21}{8}$.
16. $\frac{5}{8}$, $\frac{15}{8}$.
17. $\frac{5}{8}$, $\frac{25}{8}$.
18. $\frac{7}{8}$, $\frac{21}{8}$.
19. $\frac{7}{8}$, $\frac{35}{8}$.
20. $\frac{7}{8}$, $\frac{49}{8}$.
21. $\frac{1}{16}$, $\frac{3}{16}$.
22. $\frac{1}{16}$, $\frac{7}{16}$.
23. $\frac{3}{16}$, $\frac{15}{16}$.
24. $\frac{5}{16}$, $\frac{45}{16}$.
25. $\frac{7}{16}$, $\frac{35}{16}$.

26. By what should you multiply the numerator of the fraction $\frac{3}{32}$ to multiply the fraction by 5? by 7? by 15?

27. How should you multiply the fraction $\frac{4}{5}$ by 3? by 7? by 9? by 23?

DIVIDING A NUMERATOR

All work oral

1. This line has been divided into how many equal parts? The first of the two black portions is $\frac{3}{16}$ of the line. The second is how many sixteenths of the line?

2. In Ex. 1, $\frac{3}{16}$ is what part as long as $\frac{6}{16}$? Dividing the numerator of $\frac{6}{16}$ by 2 does what to the fraction?

3. Read and learn this statement:

Dividing the numerator by any number divides the fraction by that number.

4. If you divide the numerator of the fraction $\frac{9}{16}$ by 3, what does the fraction become? By what number have you divided the fraction?

In each of these cases state the number by which the numerator of the first fraction was divided to make the numerator of the second, and tell what this did to the fraction:

5. $\frac{4}{5}$, $\frac{2}{5}$.	10. $\frac{6}{8}$, $\frac{1}{8}$.	15. $\frac{5}{8}$, $\frac{1}{8}$.	20. $\frac{15}{16}$, $\frac{3}{16}$.
6. $\frac{4}{5}$, $\frac{1}{5}$.	11. $\frac{6}{8}$, $\frac{3}{8}$.	16. $\frac{5}{16}$, $\frac{1}{16}$.	21. $\frac{15}{16}$, $\frac{1}{16}$.
7. $\frac{2}{3}$, $\frac{1}{3}$.	12. $\frac{6}{8}$, $\frac{2}{8}$.	17. $\frac{9}{16}$, $\frac{3}{16}$.	22. $\frac{9}{32}$, $\frac{3}{32}$.
8. $\frac{3}{4}$, $\frac{1}{4}$.	13. $\frac{4}{12}$, $\frac{1}{12}$.	18. $\frac{9}{16}$, $\frac{1}{16}$.	23. $\frac{15}{32}$, $\frac{5}{32}$.
9. $\frac{3}{8}$, $\frac{1}{8}$.	14. $\frac{6}{12}$, $\frac{1}{12}$.	19. $\frac{15}{16}$, $\frac{5}{16}$.	24. $\frac{21}{32}$, $\frac{3}{32}$.

25. By what should you divide the numerator of the fraction $\frac{27}{32}$ to divide the fraction by 9? By what should you multiply the numerator of the fraction $\frac{3}{4}$ to multiply the fraction by 9?

26. How should you divide the fraction $\frac{3}{8}$ by 3?

MULTIPLYING A DENOMINATOR

All work oral

1. How many eighths of this circle are there in half of the circle? Then $\frac{1}{8}$ is what part of $\frac{1}{2}$? If we divide $\frac{1}{2}$ of the circle by 4, we have what part of the circle? What is the effect of multiplying the denominator of $\frac{1}{2}$ by 4?

2. Multiplying the denominator of any fraction by 4 does what to the fraction itself?

3. Read and learn this statement:

Multiplying the denominator by any number divides the fraction by that number.

4. Look at $\frac{1}{4}$ of the above circle. If you multiply the denominator by 2, what does the fraction become? This is what part of $\frac{1}{4}$?

In each of these cases state the number by which the denominator of the first fraction was multiplied to make the denominator of the second, and tell what this did to the fraction:

5. $\frac{1}{2}$, $\frac{1}{8}$.	10. $\frac{1}{3}$, $\frac{1}{6}$.	15. $\frac{1}{4}$, $\frac{1}{8}$.	20. $\frac{1}{8}$, $\frac{1}{16}$.
6. $\frac{1}{2}$, $\frac{1}{6}$.	11. $\frac{1}{3}$, $\frac{1}{18}$.	16. $\frac{1}{4}$, $\frac{1}{16}$.	21. $\frac{1}{8}$, $\frac{1}{32}$.
7. $\frac{1}{2}$, $\frac{1}{10}$.	12. $\frac{1}{3}$, $\frac{1}{15}$.	17. $\frac{1}{4}$, $\frac{1}{32}$.	22. $\frac{1}{8}$, $\frac{1}{64}$.
8. $\frac{1}{2}$, $\frac{1}{12}$.	13. $\frac{2}{3}$, $\frac{2}{15}$.	18. $\frac{3}{4}$, $\frac{3}{32}$.	23. $\frac{3}{8}$, $\frac{3}{32}$.
9. $\frac{1}{2}$, $\frac{1}{16}$.	14. $\frac{2}{3}$, $\frac{2}{9}$.	19. $\frac{3}{4}$, $\frac{3}{64}$.	24. $\frac{3}{8}$, $\frac{3}{16}$.

25. By what should you multiply the denominator of the fraction $\frac{7}{8}$ to divide the fraction by 5? by 4? by 6?

26. How should you divide the fraction $\frac{4}{5}$ by 3? by 9?

DIVIDING A DENOMINATOR

All work oral

1. Half of an apple is how many times $\frac{1}{4}$ of the apple? Dividing the denominator of $\frac{1}{4}$ by 2 does what to the fraction? Draw a figure on the board.

2. In the same way, dividing the denominator of the fraction $\frac{3}{8}$ by 4 gives what fraction? This is how many times the fraction $\frac{3}{8}$? Draw a figure on the board.

3. Read and learn this statement:

Dividing the denominator by any number multiplies the fraction by that number.

4. If you divide the denominator of the fraction $\frac{9}{16}$ by 4, what does the fraction become? By what number have you multiplied the fraction?

In each of these cases state the number by which the denominator of the first fraction was divided to make the denominator of the second, and tell what this did to the fraction:

5. $\frac{1}{4}$, $\frac{1}{2}$.	**10.** $\frac{3}{8}$, $\frac{3}{2}$.	**15.** $\frac{3}{16}$, $\frac{3}{4}$.	**20.** $\frac{3}{32}$, $\frac{3}{4}$.
6. $\frac{3}{4}$, $\frac{3}{2}$.	**11.** $\frac{1}{16}$, $\frac{1}{8}$.	**16.** $\frac{3}{16}$, $\frac{3}{2}$.	**21.** $\frac{3}{32}$, $\frac{3}{8}$.
7. $\frac{1}{8}$, $\frac{1}{2}$.	**12.** $\frac{1}{16}$, $\frac{1}{2}$.	**17.** $\frac{1}{32}$, $\frac{1}{8}$.	**22.** $\frac{5}{32}$, $\frac{5}{2}$.
8. $\frac{1}{8}$, $\frac{1}{4}$.	**13.** $\frac{1}{16}$, $\frac{1}{4}$.	**18.** $\frac{1}{32}$, $\frac{1}{16}$.	**23.** $\frac{25}{32}$, $\frac{25}{16}$.
9. $\frac{3}{8}$, $\frac{3}{4}$.	**14.** $\frac{3}{16}$, $\frac{3}{8}$.	**19.** $\frac{1}{32}$, $\frac{1}{2}$.	**24.** $\frac{25}{64}$, $\frac{25}{32}$.

25. By what should you divide the denominator of the fraction $\frac{3}{64}$ to multiply the fraction by 8? By what should you multiply the numerator of the fraction $\frac{3}{64}$ to multiply the fraction by 8?

A SILENT READING LESSON

We add and subtract only like things; that is, we say

3 apples + 5 apples = 8 apples

or 8 apples − 3 apples = 5 apples.

Similarly, $\frac{3}{8} + \frac{5}{8} = \frac{8}{8}$,

and $\frac{8}{8} - \frac{3}{8} = \frac{5}{8}$.

When we say 3 marbles + 5 pencils = 8 things, we give the name "thing" to each object. In adding $\frac{3}{4}$ and $\frac{5}{8}$ we must give them the same name; that is, the same denominator. We generally make this denominator as small as we can; that is, we use the *least common denominator.*

Thus, in adding $\frac{3}{4}$ and $\frac{5}{8}$, we write each fraction as eighths.

We then add as here shown.

Since $\frac{11}{8} = 1\frac{3}{8}$, the result is $1\frac{3}{8}$.

$$\begin{array}{rcl} \frac{3}{4} & = & \frac{6}{8} \\ \frac{5}{8} & = & \underline{\frac{5}{8}} \\ & & \frac{11}{8} = 1\frac{3}{8} \end{array}$$

When John reduced to lowest terms three measurements which he had taken, he had $\frac{1}{4}$ ft., $\frac{3}{8}$ ft., and $\frac{5}{12}$ ft.

If he wishes to add these measurements, he must choose the same name (denominator) for the fractions.

He cannot reduce 4ths, 8ths, and 12ths to 12ths, but he can reduce them to 24ths. He therefore writes

$$\begin{array}{rcl} \frac{1}{4} & = & \frac{6}{24} \\ \frac{3}{8} & = & \frac{9}{24} \\ \frac{5}{12} & = & \underline{\frac{10}{24}} \\ & & \frac{25}{24} = 1\frac{1}{24}. \end{array}$$

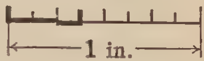
That is, the result that John finds is $1\frac{1}{24}$ ft.

Adding Fractions. Let us now have a little talk about some examples in adding fractions. You will then have no great difficulty with your work in addition.

1. Add $\frac{1}{4}$ in. and $\frac{1}{8}$ in.

Look at this picture of a 1-inch line divided into eighths.

How many eighths are there in $\frac{1}{4}$?



If to this we add $\frac{1}{8}$, how many eighths do we then have?

Copy and complete this statement: $\frac{1}{4}+\frac{1}{8}=\frac{\quad}{8}+\frac{1}{8}=\frac{\quad}{8}$.

2. Add $\frac{3}{4}$ in. and $\frac{5}{16}$ in.

What name (denominator) shall we use?

Write $\frac{3}{4}$ with this denominator.

Write $\frac{5}{16}$ with this denominator, if necessary.

Adding these two fractions, what is the result?

Write the result as a mixed number.

3. Add $\frac{1}{2}$ and $\frac{2}{3}$.

What name (denominator) shall we use?

Write $\frac{1}{2}$ with this denominator.

Write $\frac{2}{3}$ with this denominator.

What is the result?

4. Add $\frac{3}{4}$, $\frac{5}{8}$, and $\frac{1}{3}$.

What is the smallest number which contains the numbers 4, 8, and 3 exactly?

Then what name (denominator) shall we use?

Then $\frac{3}{4}$ is how many twenty-fourths? $\frac{5}{8}$ is how many twenty-fourths? $\frac{1}{3}$ is how many twenty-fourths?

How many twenty-fourths do we have in all?

Is this reduced to lowest terms? What is the result?

Express the result as a mixed number.

ADDING FRACTIONS

Numbers 1 to 6, oral

1. Express $\frac{1}{4}$ as eighths. To the result add $\frac{5}{8}$.

2. If you fasten a strip of molding $\frac{1}{4}$ in. thick to a strip of wood $\frac{5}{8}$ in. thick, how thick are the two together?

3. Express $\frac{4}{5}$ as tenths. To the result add $\frac{3}{10}$.

4. If you lay a book $\frac{4}{5}$ in. thick on a notebook $\frac{3}{10}$ in. thick, how thick are the two together?

5. Express $\frac{2}{3}$ as sixths. To the result add $\frac{1}{6}$.

6. If you lay a piece of cloth $\frac{2}{3}$ yd. wide beside a piece $\frac{1}{6}$ yd. wide, how wide are the two together?

7. Some plaster $\frac{3}{8}$ in. thick is coated with a finer plaster $\frac{3}{16}$ in. thick. How thick is the plaster now?

8. A plate of brass $\frac{1}{32}$ in. thick is laid on a plate of iron $\frac{3}{16}$ in. thick. What is the total thickness?

9. An iron rod $\frac{15}{16}$ in. in diameter is plated all over with brass $\frac{1}{32}$ in. thick. What is then the diameter?

10. A piece of cardboard $\frac{1}{64}$ in. thick is laid on a book $\frac{5}{8}$ in. thick. How thick are the two together?

Add the following fractions:

11. $\frac{3}{4}, \frac{7}{24}$.	13. $\frac{3}{8}, \frac{13}{48}$.	15. $\frac{3}{4}, \frac{1}{48}$.	17. $\frac{5}{16}, \frac{7}{24}$.
12. $\frac{3}{4}, \frac{13}{24}$.	14. $\frac{7}{8}, \frac{23}{48}$.	16. $\frac{3}{4}, \frac{7}{48}$.	18. $\frac{3}{16}, \frac{11}{24}$.

19. Add $\frac{1}{2}$ in., $\frac{1}{3}$ in., $\frac{2}{3}$ in., $\frac{1}{4}$ in., $\frac{1}{6}$ in., and $\frac{1}{12}$ in.

Add the following fractions as indicated:

20. $\frac{1}{2}+\frac{1}{4}+\frac{1}{8}$.	22. $\frac{1}{3}+\frac{1}{4}+\frac{1}{12}$.	24. $\frac{1}{3}+\frac{1}{8}+\frac{1}{12}$.
21. $\frac{1}{2}+\frac{3}{4}+\frac{1}{8}$.	23. $\frac{2}{3}+\frac{3}{4}+\frac{1}{12}$.	25. $\frac{2}{3}+\frac{5}{8}+\frac{1}{12}$.

Adding Mixed Numbers. 1. If Kate needs $5\frac{2}{3}$ yd. of cloth for one piece of work and $3\frac{2}{3}$ yd. for another, how much cloth does she need in all?

First, $\frac{2}{3} + \frac{2}{3} = \frac{4}{3} = 1\frac{1}{3}$.

Write $\frac{1}{3}$ under the fractions and add 1 to units.

Then $1 + 3 + 5 = 9$.

That is, the result is $9\frac{1}{3}$ yd.

$$\begin{array}{r} 5\frac{2}{3} \\ 3\frac{2}{3} \\ \hline 9\frac{1}{3} \end{array}$$

2. Each of three girls, Rose, May, and Edith, is making a dress. Rose uses $2\frac{1}{2}$ yd. of cloth, May $4\frac{2}{3}$ yd., and Edith $3\frac{3}{4}$ yd. How much cloth do they use in all?

Write the fractions as 12ths, because 12 is the smallest number that contains 2, 3, and 4.

Adding, the result is $9\frac{23}{12}$ yd., or, in simpler form, $10\frac{11}{12}$ yd.

$$\begin{array}{rcl} 2\frac{1}{2} & = & 2\frac{6}{12} \\ 4\frac{2}{3} & = & 4\frac{8}{12} \\ 3\frac{3}{4} & = & 3\frac{9}{12} \\ \hline & & 9\frac{23}{12} = 10\frac{11}{12} \end{array}$$

ADDING MIXED NUMBERS

1. Sarah uses $\frac{7}{8}$ yd. of cloth for a dress for one of her dolls and $\frac{1}{2}$ yd. for another. She also uses $\frac{3}{8}$ yd. in making a jacket for the larger doll. How much cloth does she use in all?

2. Making no allowance for doors and windows, how many feet of picture molding will be needed to go round a classroom $22\frac{3}{4}$ ft. long and $18\frac{1}{2}$ ft. wide?

3. James has a wooden box. The cover and bottom of the box are made of $\frac{5}{8}$-inch boards, and the inside depth is $14\frac{1}{4}$ in. What is the total height of the box?

DRILL CHART IN ADDING FRACTIONS

Copy and add the following as rapidly as you can:

1. $\frac{1}{2}$	6. $\frac{1}{4}$	11. $1\frac{1}{2}$	16. $3\frac{3}{4}$	21. $5\frac{9}{16}$	26. $1\frac{1}{3}$
$\frac{3}{4}$	$\frac{1}{8}$	$1\frac{7}{8}$	$2\frac{5}{8}$	$3\frac{5}{8}$	$1\frac{1}{2}$
2. $\frac{1}{2}$	7. $\frac{3}{4}$	12. $2\frac{1}{2}$	17. $2\frac{3}{4}$	22. $2\frac{11}{16}$	27. $2\frac{2}{3}$
$\frac{3}{8}$	$\frac{1}{8}$	$3\frac{5}{8}$	$3\frac{7}{8}$	$3\frac{5}{8}$	$3\frac{1}{2}$
3. $\frac{1}{2}$	8. $\frac{1}{4}$	13. $3\frac{1}{2}$	18. $2\frac{1}{16}$	23. $3\frac{11}{16}$	28. $2\frac{1}{3}$
$\frac{7}{8}$	$\frac{3}{8}$	$2\frac{3}{8}$	$1\frac{1}{2}$	$4\frac{7}{8}$	$3\frac{3}{4}$
4. $\frac{1}{2}$	9. $\frac{1}{4}$	14. $4\frac{1}{2}$	19. $2\frac{3}{16}$	24. $5\frac{13}{16}$	29. $3\frac{2}{3}$
$\frac{5}{8}$	$\frac{5}{8}$	$3\frac{1}{8}$	$3\frac{5}{8}$	$2\frac{5}{8}$	$2\frac{3}{4}$
5. $\frac{1}{2}$	10. $\frac{3}{4}$	15. $2\frac{1}{4}$	20. $3\frac{7}{16}$	25. $3\frac{15}{16}$	30. $3\frac{2}{3}$
$\frac{1}{8}$	$\frac{7}{8}$	$3\frac{5}{8}$	$2\frac{5}{8}$	$3\frac{7}{8}$	$2\frac{7}{8}$

Copy and add the following:

31. $4\frac{1}{2}$	33. $3\frac{1}{3}$	35. $12\frac{2}{3}$	37. $26\frac{2}{3}$	39. $18\frac{1}{3}$	41. $32\frac{7}{8}$
$\frac{1}{2}$	$2\frac{2}{3}$	$2\frac{1}{3}$	$15\frac{2}{3}$	$8\frac{3}{8}$	$5\frac{9}{16}$
32. 3	34. $4\frac{1}{2}$	36. $12\frac{1}{2}$	38. $29\frac{1}{4}$	40. $22\frac{7}{8}$	42. $15\frac{3}{8}$
$3\frac{1}{2}$	$3\frac{3}{4}$	$36\frac{1}{4}$	$4\frac{1}{6}$	$5\frac{1}{2}$	$3\frac{5}{16}$

Copy and add the following:

43. $2\frac{1}{2}+\frac{3}{4}+\frac{5}{8}$.
46. $3\frac{1}{2}+3\frac{3}{4}+2\frac{5}{8}$.
49. $2\frac{3}{4}+3\frac{3}{8}+3\frac{9}{16}$.
44. $3\frac{1}{3}+\frac{5}{6}+\frac{1}{2}$.
47. $3\frac{2}{3}+1\frac{5}{6}+\frac{1}{2}$.
50. $3\frac{3}{4}+2\frac{7}{8}+7\frac{9}{16}$.
45. $2\frac{7}{8}+\frac{2}{3}+\frac{3}{4}$.
48. $2\frac{3}{8}+3\frac{3}{4}+\frac{5}{16}$.
51. $2\frac{5}{8}+3\frac{1}{2}+4\frac{15}{16}$.

Subtracting Fractions. 1. Edith and Emily walk home together after school. Edith's home is $\frac{1}{2}$ mi. from the school, and Emily's is $\frac{3}{10}$ mi. from it. How far is it between their homes?

To take $\frac{3}{10}$ mi. from $\frac{1}{2}$ mi., use the denominator 10.

The result is $\frac{2}{10}$, or $\frac{1}{5}$; that is, it is $\frac{1}{5}$ mi. between their homes.

$$\begin{array}{rcl} \frac{1}{2} & = & \frac{5}{10} \\ \frac{3}{10} & = & \underline{\frac{3}{10}} \\ & & \frac{2}{10} = \frac{1}{5} \end{array}$$

2. Walter saws a strip $4\frac{3}{8}$ in. wide from a board 14 in. wide. How wide is the part of the board that is left?

First, think of 14 as $13\frac{8}{8}$.

Then subtract $4\frac{3}{8}$ from $13\frac{8}{8}$.

The result is $9\frac{5}{8}$; that is, the board that is left is $9\frac{5}{8}$ in. wide.

$$\begin{array}{rcr} 14 & = & 13\frac{8}{8} \\ 4\frac{3}{8} & = & \underline{4\frac{3}{8}} \\ & & 9\frac{5}{8} \end{array}$$

SUBTRACTING FRACTIONS

1. If Jenny has $\frac{5}{8}$ yd. of ribbon and uses $\frac{1}{2}$ yd. in trimming some sleeves, how much ribbon has she left?

2. If you live $\frac{3}{4}$ mi. from school, how far have you still to go when you have walked $\frac{3}{8}$ mi. toward home?

3. In making a bird house, Fred saws a piece $4\frac{7}{8}$ in. long from a board 16 in. long. How much is left?

4. Gladys has a piece of ribbon 34 in. long and uses $18\frac{1}{2}$ in. in trimming a bag. How much ribbon has she left?

5. On an automobile trip of 54 mi., Jack stops to fix a tire after going $9\frac{3}{4}$ mi. How much farther has he still to go?

6. How much is left after taking $4\frac{7}{8}$ gal. from 10 gal.?

Subtracting from a Mixed Number. From $23\frac{1}{8}$ in. of wire, James uses $8\frac{3}{4}$ in. for a toy airplane. How much wire has he left?

$$\begin{array}{rcr} 23\frac{1}{8} & = & 22\frac{9}{8} \\ 8\frac{3}{4} & = & \underline{8\frac{6}{8}} \\ & & 14\frac{3}{8} \end{array}$$

First, think of $23\frac{1}{8}$ as $22\frac{9}{8}$.

Then think of $8\frac{3}{4}$ as $8\frac{6}{8}$, and subtract it from $22\frac{9}{8}$ in the usual way.

The result is $14\frac{3}{8}$; that is, James has $14\frac{3}{8}$ in. of wire left.

SUBTRACTING FROM A MIXED NUMBER

1. If Minnie has $32\frac{1}{4}$ in. of cloth and uses $9\frac{3}{4}$ in., how much cloth has she left?

2. If one book is $8\frac{1}{4}$ in. long, and another is $5\frac{13}{16}$ in. long, what is the difference between their lengths?

3. If Frank has a piece of board $16\frac{1}{8}$ in. long and needs a piece only $13\frac{3}{4}$ in. long, how much must he cut off?

Subtract as follows:

4. $\begin{array}{r} 2\frac{5}{8} \\ \underline{\frac{3}{8}} \end{array}$	8. $\begin{array}{r} 8\frac{3}{8} \\ \underline{\frac{3}{4}} \end{array}$	12. $\begin{array}{r} 9\frac{2}{5} \\ \underline{8\frac{3}{8}} \end{array}$	16. $\begin{array}{r} 9\frac{7}{12} \\ \underline{8\frac{1}{2}} \end{array}$	20. $\begin{array}{r} 6\frac{1}{2} \\ \underline{4\frac{3}{4}} \end{array}$	24. $\begin{array}{r} 5\frac{5}{12} \\ \underline{\frac{5}{6}} \end{array}$
5. $\begin{array}{r} 6\frac{3}{8} \\ \underline{\frac{3}{4}} \end{array}$	9. $\begin{array}{r} 9\frac{1}{4} \\ \underline{3\frac{5}{8}} \end{array}$	13. $\begin{array}{r} 9\frac{5}{6} \\ \underline{8} \end{array}$	17. $\begin{array}{r} 9\frac{2}{3} \\ \underline{2\frac{4}{5}} \end{array}$	21. $\begin{array}{r} 6\frac{3}{4} \\ \underline{4\frac{1}{2}} \end{array}$	25. $\begin{array}{r} 8\frac{5}{12} \\ \underline{\frac{7}{8}} \end{array}$
6. $\begin{array}{r} 9\frac{1}{2} \\ \underline{4\frac{1}{3}} \end{array}$	10. $\begin{array}{r} 8\frac{3}{4} \\ \underline{7} \end{array}$	14. $\begin{array}{r} 6\frac{1}{4} \\ \underline{3\frac{5}{8}} \end{array}$	18. $\begin{array}{r} 8\frac{1}{5} \\ \underline{6\frac{5}{8}} \end{array}$	22. $\begin{array}{r} 7\frac{1}{8} \\ \underline{2\frac{1}{2}} \end{array}$	26. $\begin{array}{r} 9\frac{15}{16} \\ \underline{1\frac{1}{8}} \end{array}$
7. $\begin{array}{r} 2\frac{7}{8} \\ \underline{1\frac{1}{8}} \end{array}$	11. $\begin{array}{r} 6\frac{5}{8} \\ \underline{3\frac{1}{4}} \end{array}$	15. $\begin{array}{r} 6\frac{1}{3} \\ \underline{4\frac{3}{4}} \end{array}$	19. $\begin{array}{r} 5\frac{1}{2} \\ \underline{2\frac{1}{4}} \end{array}$	23. $\begin{array}{r} 7\frac{1}{2} \\ \underline{2\frac{1}{8}} \end{array}$	27. $\begin{array}{r} 9\frac{1}{8} \\ \underline{1\frac{15}{16}} \end{array}$

DRILL CHART IN FRACTIONS

Copy, add, and check each result:

1.	2.	3.	4.	5.	6.
$2\frac{1}{4}$	$2\frac{2}{3}$	$3\frac{1}{2}$	$2\frac{2}{5}$	$1\frac{3}{8}$	$3\frac{2}{9}$
$2\frac{2}{3}$	$3\frac{3}{4}$	$2\frac{1}{3}$	$4\frac{1}{3}$	$1\frac{5}{16}$	$3\frac{1}{3}$
$3\frac{1}{2}$	$4\frac{1}{3}$	$2\frac{2}{3}$	$3\frac{1}{6}$	$2\frac{3}{4}$	$7\frac{5}{6}$
$4\frac{1}{12}$	$5\frac{7}{12}$	$3\frac{5}{6}$	$5\frac{4}{5}$	$7\frac{1}{2}$	$5\frac{1}{2}$

7. From $14\frac{7}{8} + 23\frac{3}{4}$ take $9\frac{1}{2} + 7\frac{11}{16}$.

Copy, add, and check each result:

8.	9.	10.	11.	12.	13.
$3\frac{1}{2}$	$5\frac{2}{3}$	$3\frac{1}{8}$	$1\frac{1}{5}$	$2\frac{3}{4}$	$5\frac{1}{5}$
$4\frac{2}{3}$	$4\frac{1}{6}$	$4\frac{3}{4}$	$8\frac{3}{4}$	$5\frac{7}{8}$	$2\frac{2}{3}$
$2\frac{3}{4}$	$7\frac{3}{4}$	$9\frac{1}{4}$	$6\frac{5}{8}$	$3\frac{1}{2}$	$3\frac{5}{6}$
$5\frac{3}{4}$	$5\frac{7}{8}$	$6\frac{7}{8}$	$9\frac{1}{2}$	$4\frac{3}{8}$	$4\frac{3}{5}$
$7\frac{1}{12}$	$9\frac{5}{6}$	$4\frac{1}{2}$	$4\frac{9}{10}$	$9\frac{1}{4}$	$2\frac{1}{2}$

Subtract as follows:

14. $\frac{7}{8}$	18. $\frac{3}{4}$	22. $\frac{3}{5}$	26. $3\frac{1}{2}$	30. $5\frac{1}{2}$	34. $12\frac{1}{2}$
$\frac{1}{4}$	$\frac{5}{12}$	$\frac{1}{2}$	$2\frac{1}{3}$	$4\frac{1}{4}$	$\frac{3}{8}$
15. $\frac{5}{8}$	19. $\frac{5}{12}$	23. $\frac{7}{8}$	27. $5\frac{1}{4}$	31. $5\frac{1}{4}$	35. $12\frac{3}{8}$
$\frac{1}{16}$	$\frac{1}{4}$	$\frac{3}{4}$	$2\frac{3}{8}$	$4\frac{1}{2}$	$9\frac{1}{2}$
16. $\frac{1}{2}$	20. $\frac{5}{6}$	24. $\frac{7}{8}$	28. 8	32. $6\frac{7}{8}$	36. $15\frac{2}{3}$
$\frac{1}{12}$	$\frac{2}{3}$	$\frac{2}{3}$	$6\frac{2}{5}$	$5\frac{3}{4}$	$5\frac{1}{2}$
17. $\frac{7}{8}$	21. $\frac{1}{5}$	25. $\frac{2}{3}$	29. 9	33. $6\frac{3}{4}$	37. $25\frac{1}{2}$
$\frac{1}{24}$	$\frac{1}{6}$	$\frac{1}{2}$	$7\frac{5}{8}$	$5\frac{7}{8}$	$6\frac{2}{3}$

SPEED TEST CHART IN FRACTIONS

In Exs. 1–30, see how many you can copy, subtract, and check in 10 min. or less:

1. $8\frac{3}{4}$ $2\frac{1}{2}$	**7.** $7\frac{1}{2}$ $3\frac{3}{8}$	**13.** $5\frac{7}{8}$ $2\frac{1}{4}$	**19.** $9\frac{2}{3}$ $5\frac{3}{4}$	**25.** $22\frac{1}{3}$ $2\frac{1}{5}$
2. $9\frac{5}{8}$ $3\frac{1}{2}$	**8.** $8\frac{5}{8}$ $3\frac{1}{4}$	**14.** $9\frac{2}{3}$ $4\frac{1}{6}$	**20.** $7\frac{1}{4}$ $3\frac{2}{3}$	**26.** $34\frac{2}{3}$ $6\frac{4}{5}$
3. 2 $\frac{1}{4}$	**9.** $4\frac{1}{2}$ $1\frac{1}{4}$	**15.** $\frac{19}{24}$ $\frac{2}{3}$	**21.** $2\frac{7}{8}$ $\frac{17}{32}$	**27.** $12\frac{3}{4}$ $7\frac{7}{8}$
4. 10 $\frac{7}{8}$	**10.** $6\frac{1}{2}$ $2\frac{5}{8}$	**16.** $\frac{7}{10}$ $\frac{1}{3}$	**22.** $3\frac{1}{8}$ $\frac{5}{32}$	**28.** $16\frac{3}{8}$ $2\frac{3}{4}$
5. 12 $\frac{7}{16}$	**11.** $7\frac{1}{2}$ $4\frac{3}{16}$	**17.** $2\frac{7}{8}$ $\frac{1}{16}$	**23.** $2\frac{5}{6}$ $\frac{2}{3}$	**29.** $19\frac{3}{16}$ $14\frac{3}{4}$
6. 30 $\frac{11}{12}$	**12.** $7\frac{1}{4}$ $5\frac{11}{16}$	**18.** $3\frac{7}{8}$ $\frac{13}{16}$	**24.** $7\frac{1}{6}$ $\frac{2}{3}$	**30.** $32\frac{11}{16}$ $18\frac{5}{8}$

31. Add $14\frac{1}{2}$ in., $23\frac{3}{4}$ in., $6\frac{1}{4}$ in., $22\frac{7}{8}$ in., and $14\frac{3}{8}$ in.

Copy, add, and check in less than 4 min.:

32. $3\frac{3}{4}$ $1\frac{1}{2}$ $2\frac{11}{12}$ $5\frac{1}{4}$ $6\frac{5}{12}$	**33.** $8\frac{2}{3}$ $9\frac{1}{6}$ $8\frac{1}{3}$ $4\frac{5}{6}$ $3\frac{1}{3}$	**34.** $6\frac{1}{4}$ $3\frac{1}{2}$ $2\frac{1}{8}$ $6\frac{3}{8}$ $7\frac{5}{8}$	**35.** $9\frac{1}{2}$ $2\frac{1}{3}$ $3\frac{3}{4}$ $8\frac{7}{8}$ $1\frac{5}{6}$	**36.** $18\frac{1}{2}$ $2\frac{9}{16}$ $23\frac{7}{8}$ $29\frac{3}{4}$ $38\frac{5}{16}$

Multiplying by a Whole Number, without Canceling. If Tom has a quarter of a dollar and Jane has three times as much, how much has Jane?

Just as 3 times 1 in. is 3 in.,
so 3 times 1 quarter is 3 quarters,
or $3 \times \frac{1}{4} = \frac{3}{4}$.

That is, Jane has 3 quarters of a dollar, or $\$\frac{3}{4}$.

To multiply a fraction by a whole number, multiply the numerator by the whole number.

MULTIPLYING BY A WHOLE NUMBER

Multiply rapidly as follows, reducing each result to a mixed number when possible:

1. $3 \times \frac{1}{2}$.
2. $5 \times \frac{1}{2}$.
3. $7 \times \frac{1}{2}$.
4. $9 \times \frac{1}{2}$.
5. $11 \times \frac{1}{2}$.
6. $15 \times \frac{1}{2}$.
7. $10 \times \frac{1}{3}$.
8. $11 \times \frac{1}{3}$.
9. $13 \times \frac{1}{3}$.
10. $14 \times \frac{1}{3}$.
11. $26 \times \frac{1}{3}$.
12. $20 \times \frac{1}{3}$.
13. $22 \times \frac{2}{3}$.
14. $14 \times \frac{2}{3}$.
15. $5 \times \frac{2}{3}$.
16. $7 \times \frac{2}{3}$.
17. $8 \times \frac{2}{3}$.
18. $5 \times \frac{1}{4}$.
19. $7 \times \frac{1}{4}$.
20. $9 \times \frac{1}{4}$.
21. $11 \times \frac{1}{4}$.
22. $13 \times \frac{1}{4}$.
23. $15 \times \frac{1}{4}$.
24. $17 \times \frac{1}{4}$.
25. $11 \times \frac{3}{4}$.
26. $13 \times \frac{3}{4}$.
27. $15 \times \frac{3}{4}$.
28. $21 \times \frac{3}{4}$.
29. $3 \times \frac{1}{8}$.
30. $3 \times \frac{3}{8}$.
31. $2 \times \frac{3}{4}$.
32. $3 \times \frac{3}{4}$.
33. $3 \times \frac{5}{8}$.
34. $3 \times \frac{7}{8}$.
35. $5 \times \frac{1}{8}$.
36. $5 \times \frac{3}{8}$.
37. $5 \times \frac{5}{8}$.
38. $5 \times \frac{7}{8}$.
39. $11 \times \frac{1}{8}$.
40. $11 \times \frac{3}{8}$.
41. $11 \times \frac{5}{8}$.
42. $11 \times \frac{7}{8}$.

Multiplying by a Whole Number, with Canceling. If you have 4 quarters, how many dollars have you?

In such a simple case we easily see that

$$4 \times \frac{1}{4} = \frac{\overset{1}{\cancel{4}}}{\cancel{4}} = 1.$$

That is, you have one dollar, or $1.

Before actually multiplying, indicate the multiplication and, if possible, cancel common factors.

That is, in a case in which you have to multiply $\frac{7}{8}$ by 6, first indicate the multiplication by writing the work in this form:

$$\frac{6 \times 7}{8}.$$

Canceling, the result is $\frac{21}{4}$, or, in simpler form, $5\frac{1}{4}$.

$$\boxed{\frac{\overset{3}{\cancel{6}} \times 7}{\underset{4}{\cancel{8}}} = \frac{21}{4} = 5\tfrac{1}{4}}$$

MULTIPLYING BY A WHOLE NUMBER

Numbers 1 to 28, oral

Multiply rapidly as follows:

1. $2 \times \frac{1}{2}$.	8. $4 \times \frac{3}{8}$.	15. $9 \times \frac{1}{3}$.	22. $5 \times \frac{1}{5}$.
2. $2 \times \frac{1}{4}$.	9. $8 \times \frac{5}{8}$.	16. $9 \times \frac{2}{3}$.	23. $5 \times \frac{2}{5}$.
3. $4 \times \frac{1}{4}$.	10. $4 \times \frac{7}{8}$.	17. $4 \times \frac{1}{2}$.	24. $9 \times \frac{1}{3}$.
4. $4 \times \frac{3}{4}$.	11. $3 \times \frac{1}{3}$.	18. $8 \times \frac{1}{2}$.	25. $4 \times \frac{5}{8}$.
5. $2 \times \frac{3}{4}$.	12. $3 \times \frac{2}{3}$.	19. $8 \times \frac{1}{4}$.	26. $5 \times \frac{1}{10}$.
6. $2 \times \frac{1}{8}$.	13. $6 \times \frac{1}{3}$.	20. $8 \times \frac{3}{4}$.	27. $5 \times \frac{3}{10}$.
7. $4 \times \frac{1}{8}$.	14. $6 \times \frac{2}{3}$.	21. $6 \times \frac{1}{6}$.	28. $6 \times \frac{5}{6}$.

29. For some work which she is doing, Harriet needs 8 pieces of cloth, each $\frac{5}{8}$ yd. long. How many yards does she need in all?

30. In doing up some boxes of candy for a sale it was found that $\frac{1}{8}$ yd. of ribbon was needed for each box. If there were 24 boxes, how much ribbon was needed?

31. A class of 18 pupils made some ribbon badges, each 6 in. long. The length of each badge is what part of a yard? How many yards did they need for the 18 badges?

32. For a school sale the girls filled 48 boxes with salted almonds, each box containing 6 oz. of nuts. How many pounds of almonds did they use?

Multiply as follows, using cancellation when possible:

33. $6 \times \frac{2}{3}$.
34. $6 \times \frac{3}{4}$.
35. $6 \times \frac{7}{8}$.
36. $8 \times \frac{1}{2}$.
37. $8 \times \frac{2}{3}$.
38. $8 \times \frac{3}{4}$.
39. $9 \times \frac{1}{2}$.
40. $9 \times \frac{1}{3}$.
41. $9 \times \frac{2}{3}$.
42. $9 \times \frac{3}{4}$.
43. $3 \times \frac{7}{8}$.
44. $5 \times \frac{3}{5}$.
45. $5 \times \frac{3}{8}$.
46. $5 \times \frac{5}{8}$.
47. $5 \times \frac{5}{6}$.
48. $6 \times \frac{5}{8}$.
49. $5 \times \frac{7}{8}$.
50. $7 \times \frac{7}{8}$.
51. $8 \times \frac{7}{8}$.
52. $9 \times \frac{7}{8}$.
53. $4 \times \frac{7}{8}$.
54. $2 \times \frac{7}{8}$.
55. $12 \times \frac{3}{4}$.
56. $12 \times \frac{2}{3}$.
57. $12 \times \frac{3}{5}$.
58. $12 \times \frac{3}{8}$.
59. $16 \times \frac{3}{8}$.
60. $16 \times \frac{3}{4}$.
61. $16 \times \frac{3}{5}$.
62. $18 \times \frac{2}{3}$.
63. $18 \times \frac{5}{6}$.
64. $18 \times \frac{5}{8}$.
65. $18 \times \frac{7}{8}$.
66. $24 \times \frac{1}{2}$.
67. $24 \times \frac{1}{3}$.
68. $24 \times \frac{2}{3}$.
69. $24 \times \frac{3}{4}$.
70. $24 \times \frac{3}{8}$.
71. $36 \times \frac{7}{8}$.
72. $24 \times \frac{5}{16}$.
73. $24 \times \frac{5}{12}$.
74. $36 \times \frac{7}{16}$.
75. $42 \times \frac{5}{16}$.
76. $48 \times \frac{7}{16}$.
77. $48 \times \frac{15}{16}$.
78. $32 \times \frac{9}{16}$.
79. $32 \times \frac{11}{16}$.
80. $32 \times \frac{11}{32}$.
81. $64 \times \frac{1}{32}$.
82. $64 \times \frac{11}{32}$.
83. $64 \times \frac{15}{32}$.
84. $96 \times \frac{25}{32}$.

Multiplying a Mixed Number by a Whole Number. A grocer sells washing-soda in boxes that hold $1\frac{3}{4}$ lb. each. How many pounds of soda shall I get if I buy 6 boxes?

First, multiply $\frac{3}{4}$ by 6.

Then multiply 1 by 6.

Now add these two results.

The result, as shown in the work at the right, is $10\frac{1}{2}$; that is, I shall buy $10\frac{1}{2}$ lb. of soda.

$$\begin{array}{lcr} & & 1\frac{3}{4} \\ & & \underline{6} \\ 6 \times \frac{3}{4} & = & 4\frac{1}{2} \\ 6 \times 1 & = & \underline{6} \\ 6 \times 1\frac{3}{4} & = & 10\frac{1}{2} \end{array}$$

To multiply a mixed number by a whole number, first multiply the fractional part, then multiply the whole number, and add the two results.

MULTIPLYING A MIXED NUMBER

Multiply as follows:

1. $2 \times 1\frac{1}{2}$.	**5.** $6 \times 3\frac{1}{3}$.	**9.** $8 \times 2\frac{1}{2}$.	**13.** $20 \times 1\frac{1}{2}$.
2. $2 \times 2\frac{1}{2}$.	**6.** $8 \times 3\frac{3}{4}$.	**10.** $8 \times 1\frac{1}{2}$.	**14.** $30 \times 2\frac{1}{3}$.
3. $4 \times 1\frac{1}{2}$.	**7.** $8 \times 2\frac{5}{8}$.	**11.** $8 \times 5\frac{1}{2}$.	**15.** $36 \times 4\frac{2}{3}$.
4. $3 \times 1\frac{1}{3}$.	**8.** $9 \times 3\frac{7}{8}$.	**12.** $9 \times 5\frac{1}{3}$.	**16.** $24 \times 1\frac{3}{4}$.

17. At $27\frac{3}{4}$ mi. an hour, how far will an automobile go in 2 hr.? in 3 hr.? in 5 hr.?

Multiply as follows:

18. $24 \times 3\frac{1}{2}$.	**22.** $96 \times 2\frac{1}{16}$.	**26.** $72 \times 6\frac{11}{12}$.
19. $36 \times 3\frac{2}{3}$.	**23.** $48 \times 3\frac{1}{12}$.	**27.** $56 \times 5\frac{5}{8}$.
20. $48 \times 6\frac{3}{4}$.	**24.** $48 \times 5\frac{5}{12}$.	**28.** $64 \times 7\frac{7}{8}$.
21. $40 \times 5\frac{7}{8}$.	**25.** $60 \times 5\frac{7}{12}$.	**29.** $72 \times 7\frac{7}{8}$.

Fractional Part of a Whole Number. If there are 240 pupils in a certain school, and $\frac{3}{4}$ of them are in the primary grades, how many pupils are there in the primary grades?

Write the work in the form for canceling.

The result is 180; that is, there are 180 pupils in the primary grades.

$$\frac{3}{4} \text{ of } 240 = \frac{3 \times \overset{60}{\cancel{240}}}{\cancel{4}} = 180$$

To find a fractional part of a whole number, multiply the number by the fraction, canceling whenever possible.

FRACTIONAL PARTS

State rapidly the fractional parts indicated:

1. $\frac{1}{2}$ of 8.
2. $\frac{1}{2}$ of 16.
3. $\frac{1}{2}$ of 18.
4. $\frac{1}{2}$ of 22.
5. $\frac{1}{3}$ of 21.
6. $\frac{1}{3}$ of 27.
7. $\frac{1}{3}$ of 30.
8. $\frac{1}{4}$ of 36.
9. $\frac{1}{4}$ of 40.
10. $\frac{1}{5}$ of 40.
11. $\frac{1}{6}$ of 42.
12. $\frac{1}{7}$ of 42.
13. $\frac{1}{8}$ of 48.
14. $\frac{1}{3}$ of 24.
15. $\frac{2}{3}$ of 24.
16. $\frac{1}{3}$ of 33.
17. $\frac{2}{3}$ of 33.
18. $\frac{1}{3}$ of 36.
19. $\frac{2}{3}$ of 36.
20. $\frac{1}{3}$ of 39.
21. $\frac{2}{3}$ of 39.
22. $\frac{1}{3}$ of 60.
23. $\frac{2}{3}$ of 60.
24. $\frac{1}{3}$ of 66.
25. $\frac{2}{3}$ of 66.
26. $\frac{2}{3}$ of 90.
27. $\frac{1}{4}$ of 20.
28. $\frac{3}{4}$ of 20.
29. $\frac{1}{4}$ of 24.
30. $\frac{3}{4}$ of 24.
31. $\frac{1}{4}$ of 32.
32. $\frac{3}{4}$ of 32.
33. $\frac{1}{4}$ of 44.
34. $\frac{3}{4}$ of 40.
35. $\frac{1}{4}$ of 48.
36. $\frac{3}{4}$ of 48.
37. $\frac{1}{4}$ of 80.
38. $\frac{3}{4}$ of 80.
39. $\frac{3}{4}$ of 88.
40. $\frac{1}{5}$ of 15.
41. $\frac{2}{5}$ of 15.
42. $\frac{3}{5}$ of 15.
43. $\frac{4}{5}$ of 15.
44. $\frac{4}{5}$ of 25.
45. $\frac{1}{8}$ of 16.
46. $\frac{3}{8}$ of 16.
47. $\frac{5}{8}$ of 16.
48. $\frac{7}{8}$ of 16.
49. $\frac{3}{8}$ of 32.
50. $\frac{5}{8}$ of 32.
51. $\frac{7}{8}$ of 32.
52. $\frac{7}{8}$ of 80.

FINDING FRACTIONAL PARTS

1. If you need $\frac{3}{4}$ yd. of cloth to make a book cover, you need $\frac{3}{4}$ of how many inches? This is how many inches?

2. If you need $\frac{1}{8}$ yd. of lace for some trimming, how many inches do you need?

3. Helen asks the clerk in a store for $\frac{2}{3}$ yd. of velvet ribbon. How many inches does she wish?

4. If 1 yd. of velvet costs \$4, how much does $\frac{3}{8}$ yd. cost?

5. At 80¢ a yard, how much will $\frac{1}{2}$ yd. of gingham cost? Find the cost of $\frac{1}{4}$ yd.; of $\frac{3}{4}$ yd.; of $\frac{1}{8}$ yd.; of $\frac{5}{8}$ yd.

6. Some toweling costing 72¢ a yard is cut into lengths of $\frac{3}{4}$ yd. each. Find the cost of the material in each towel.

7. Solve Ex. 6, supposing the lengths to be $\frac{5}{8}$ yd.

8. Solve Ex. 6, supposing the lengths to be $\frac{7}{8}$ yd.

9. If you buy $\frac{3}{4}$ lb. of butter at 48¢ a pound, and $\frac{1}{2}$ lb. of tea at 80¢ a pound, how much must you pay?

10. On an automobile trip of 168 mi. Frank's father said, as he looked at the speedometer, "We have gone three quarters of the way." How many miles had they gone? How many miles had they still to go?

Find the following fractional parts:

11. $\frac{5}{8}$ of 768.	16. $\frac{5}{8}$ of 3376.	21. $\frac{3}{8}$ of 1464.
12. $\frac{1}{6}$ of 840.	17. $\frac{5}{6}$ of 1758.	22. $\frac{7}{8}$ of 3272.
13. $\frac{5}{6}$ of 774.	18. $\frac{3}{8}$ of 4976.	23. $\frac{5}{6}$ of 7764.
14. $\frac{7}{8}$ of 904.	19. $\frac{3}{8}$ of 5656.	24. $\frac{1}{10}$ of 7200.
15. $\frac{7}{8}$ of 984.	20. $\frac{5}{8}$ of 6408.	25. $\frac{3}{10}$ of 7200.

Multiplying a Whole Number by a Mixed Number. If washing-soda costs 12¢ a pound, how much shall I have to pay when I buy $7\frac{1}{2}$ lb.?

To find the answer you must multiply 12 by $7\frac{1}{2}$.

First, take $\frac{1}{2}$ of 12.

Then multiply 12 by 7.

Now add these two results.

The result is 90; that is, I shall have to pay 90¢.

$$\begin{array}{rr} & 12 \\ & \underline{7\frac{1}{2}} \\ \frac{1}{2} \text{ of } 12 = & 6 \\ 7 \times 12 = & \underline{84} \\ 7\frac{1}{2} \times 12 = & 90 \end{array}$$

To multiply a whole number by a mixed number, first multiply by the fractional part, then multiply by the whole number, and add the two results.

MULTIPLYING BY A MIXED NUMBER

1. If eggs cost 60¢ a dozen, how much must I pay for $1\frac{1}{2}$ doz.? for $2\frac{1}{2}$ doz.? for $3\frac{1}{2}$ doz.?

2. If you ride for $3\frac{3}{4}$ hr. in an automobile, going at a steady rate of 18 mi. an hour, how many miles do you go?

Multiply the following:

3. $3\frac{1}{2} \times 7$.

4. $5\frac{1}{3} \times 8$.

5. $2\frac{2}{3} \times 9$.

6. $4\frac{2}{3} \times 50$.

7. $7\frac{1}{6} \times 90$.

8. $8\frac{5}{8} \times 24$.

9. $3\frac{1}{4} \times 16$.

10. $4\frac{3}{4} \times 16$.

11. $5\frac{3}{4} \times 28$.

12. $3\frac{1}{8} \times 32$.

13. $3\frac{3}{8} \times 32$.

14. $4\frac{5}{8} \times 32$.

15. $5\frac{7}{8} \times 64$.

16. $7\frac{7}{8} \times 72$.

17. $2\frac{1}{12} \times 36$.

18. $2\frac{7}{12} \times 36$.

19. $5\frac{7}{10} \times 60$.

20. $9\frac{9}{10} \times 90$.

21. $7\frac{3}{16} \times 32$.

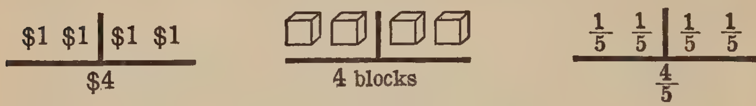
22. $8\frac{9}{16} \times 64$.

23. $9\frac{3}{32} \times 64$.

FRACTIONAL PART OF A FRACTION

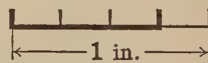
All work oral

1. How much is $\frac{1}{2}$ of \$4? $\frac{1}{2}$ of 4 blocks? $\frac{1}{2}$ of $\frac{4}{5}$?



2. How do you find $\frac{1}{2}$ of \$4? $\frac{1}{2}$ of 4¢? $\frac{1}{2}$ of $\frac{4}{5}$?

3. Here is a line, 1 in. long, on which $\frac{3}{4}$ in. has been marked off. If you take $\frac{1}{3}$ of $\frac{3}{4}$ in., what part of an inch do you have? How can you find $\frac{1}{3}$ of $\frac{3}{4}$?



A *B* *C* *D* *E* *F*

4. What part of the rectangle *A* is $\frac{1}{2}$ of $\frac{1}{2}$ of *A*?

5. Show that $\frac{1}{2}$ of $\frac{1}{3}$ of *B* is the same as $\frac{1}{3}$ of $\frac{1}{2}$ of *B*.

6. What part of *B* is $\frac{1}{3}$ of $\frac{1}{2}$ of *B*?

7. What part of *C* is $\frac{1}{3}$ of $\frac{1}{3}$ of *C*?

8. What part of *D* is $\frac{1}{2}$ of $\frac{1}{4}$ of *D*? $\frac{1}{4}$ of $\frac{1}{2}$ of *D*?

9. Point to $\frac{1}{2}$ of $\frac{3}{4}$ of *E*; to $\frac{3}{4}$ of $\frac{1}{2}$ of *E*. What part of *E* is $\frac{3}{4}$ of $\frac{1}{2}$ of *E*?

10. Point to $\frac{1}{3}$ of *F*; to $\frac{1}{4}$ of $\frac{1}{3}$ of *F*. Point also to $\frac{1}{4}$ of *F* and to $\frac{1}{3}$ of $\frac{1}{4}$ of *F*. What part of *F* is $\frac{1}{4}$ of $\frac{1}{3}$ of *F*? $\frac{1}{3}$ of $\frac{1}{4}$ of *F*?

A SILENT READING LESSON

The line AB shown below has been divided into five equal parts, and each of these, in turn, into three equal parts. Into how many equal parts is AB divided?

Let us consider the following questions:

$\frac{1}{3}$ of $\frac{1}{5}$ of the line is how many fifteenths of the line?

$\frac{1}{3}$ of $\frac{4}{5}$ is how many times as long as $\frac{1}{3}$ of $\frac{1}{5}$?

$\frac{1}{3}$ of $\frac{4}{5}$ is how many fifteenths of the line?

$\frac{2}{3}$ of $\frac{4}{5}$ is how many times as long as $\frac{1}{3}$ of $\frac{4}{5}$?

$\frac{2}{3}$ of $\frac{4}{5}$ is how many fifteenths of the line?

We may write $\frac{2}{3}$ of $\frac{4}{5}$ as $\frac{2}{3} \times \frac{4}{5}$, which we may read as either "$\frac{2}{3}$ of $\frac{4}{5}$" or "$\frac{2}{3}$ times $\frac{4}{5}$."

To multiply two fractions, multiply the numerators together for the new numerator and multiply the denominators together for the new denominator. Cancel whenever possible.

Thus, in finding $\frac{2}{3}$ of $\frac{3}{4}$, we proceed as follows:

$$\frac{\cancel{2} \times \cancel{3}}{\cancel{3} \times \underset{2}{\cancel{4}}} = \frac{1}{2}.$$

Similarly, $$\frac{3}{4} \text{ of } \frac{4}{5} = \frac{3 \times \cancel{4}}{\cancel{4} \times 5} = \frac{3}{5},$$

and $$\frac{2}{3} \times \frac{3}{4} \times \frac{7}{8} = \frac{\cancel{2} \times \cancel{3} \times 7}{\cancel{3} \times \underset{2}{\cancel{4}} \times 8} = \frac{7}{16}.$$

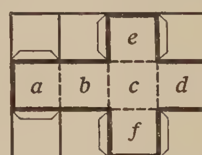
FRACTION OF A FRACTION

1. Draw a rectangle like the one here shown, making it 4 in. long and 3 in. wide. Divide it into four equal strips running one way and into three equal strips running the other way.

2. The shaded square is what part of a longer strip? of a shorter strip? of the whole rectangle?

3. How many twelfths of the rectangle is $\frac{1}{4}$ of $\frac{1}{3}$ of it?

4. In making cubes for studying fractions, the class cut out cardboard rectangles, each 4 in. long and 3 in. wide. Each pupil marked off the cardboard into four equal parts in length and three equal parts in width, and then cut and folded it as suggested by the figure. Show that each side of the cube, which is indicated by the heavy lines, is $\frac{1}{3}$ of $\frac{1}{4}$ of the rectangle.



5. How many twelfths of the rectangle is $\frac{1}{3}$ of $\frac{1}{4}$ of it?

6. The squares *a*, *b*, *c*, and *d* together are how many twelfths of the rectangle? This is how many thirds?

Multiply as follows:

7. $\frac{1}{2} \times \frac{1}{3}$.	13. $\frac{1}{3} \times \frac{3}{4}$.	19. $\frac{2}{3} \times \frac{3}{8}$.	25. $\frac{1}{4} \times \frac{1}{8}$.
8. $\frac{1}{3} \times \frac{1}{2}$.	14. $\frac{2}{3} \times \frac{3}{4}$.	20. $\frac{2}{3} \times \frac{5}{8}$.	26. $\frac{1}{4} \times \frac{3}{8}$.
9. $\frac{1}{2} \times \frac{2}{3}$.	15. $\frac{1}{2} \times \frac{1}{8}$.	21. $\frac{2}{3} \times \frac{7}{8}$.	27. $\frac{3}{4} \times \frac{5}{8}$.
10. $\frac{2}{3} \times \frac{1}{2}$.	16. $\frac{1}{2} \times \frac{3}{8}$.	22. $\frac{1}{4} \times \frac{4}{5}$.	28. $\frac{3}{4} \times \frac{7}{8}$.
11. $\frac{1}{2} \times \frac{1}{4}$.	17. $\frac{5}{8} \times \frac{1}{2}$.	23. $\frac{1}{5} \times \frac{5}{8}$.	29. $\frac{1}{2} \times \frac{1}{16}$.
12. $\frac{1}{2} \times \frac{3}{4}$.	18. $\frac{1}{3} \times \frac{3}{8}$.	24. $\frac{1}{5} \times \frac{5}{16}$.	30. $\frac{1}{2} \times \frac{3}{16}$.

31. If Henry walks 1 mi. in $\frac{1}{4}$ hr., how long will it take him, at the same rate, to walk $\frac{1}{2}$ mi.? to walk $\frac{1}{3}$ mi.?

32. If an express train runs 1 mi. in $\frac{3}{4}$ min., how long, at the same rate, will it take the train to run $\frac{5}{8}$ mi.?

33. If a train runs $\frac{2}{3}$ of a certain distance in 1 hr., what part of the distance can it run in $\frac{3}{4}$ hr.?

34. If it takes a train $\frac{3}{4}$ hr. to reach a certain station, in what fraction of an hour will it go $\frac{5}{6}$ of the distance?

35. If Frank lives $\frac{4}{5}$ mi. from school, and George lives $\frac{5}{8}$ as far, how far does George live from school?

36. If $\frac{5}{8}$ yd. of lace is needed to trim two neckbands, how much lace will be needed to trim each neckband?

37. In a certain race an automobile ran 1 mi. in 49 sec.; that is, in $\frac{49}{60}$ min. What part of a minute did it take the car to run $\frac{5}{8}$ mi.?

38. If Jane lives $\frac{7}{8}$ mi. from school, and Madge lives $\frac{1}{3}$ as far, how far from school does Madge live? If Isabel lives $\frac{1}{2}$ as far as Madge, how far from school does Isabel live?

39. Mrs. Sinclair used $\frac{7}{8}$ yd. of velvet in making one hat and $\frac{2}{5}$ as much in making another hat. How much velvet did she use for both hats?

40. Find the value of $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$; of $\frac{3}{8}$ of $\frac{4}{5}$ of $\frac{5}{12}$.

Multiply as follows:

41. $\frac{1}{8} \times \frac{4}{5}$.	**44.** $\frac{5}{9} \times \frac{3}{5}$.	**47.** $\frac{2}{3} \times \frac{9}{10}$.	**50.** $\frac{15}{32} \times \frac{4}{5}$.
42. $\frac{4}{5} \times \frac{5}{8}$.	**45.** $\frac{3}{8} \times \frac{7}{8}$.	**48.** $\frac{2}{3} \times \frac{15}{16}$.	**51.** $\frac{7}{16} \times \frac{5}{7}$.
43. $\frac{3}{5} \times \frac{5}{9}$.	**46.** $\frac{3}{4} \times \frac{8}{15}$.	**49.** $\frac{3}{4} \times \frac{5}{24}$.	**52.** $\frac{7}{16} \times \frac{8}{21}$.

Multiplying a Mixed Number by a Fraction. **1.** If I buy $4\frac{1}{2}$ lb. of butter and use half of it, how much do I use?

First, $\frac{1}{2}$ of 4 lb. = 2 lb.
Then $\frac{1}{2}$ of $\frac{1}{2}$ lb. = $\frac{1}{4}$ lb.
Adding, 2 lb. + $\frac{1}{4}$ lb. = $2\frac{1}{4}$ lb., the amount used.

2. If I have $5\frac{1}{4}$ yd. of ribbon and use $\frac{2}{3}$ of it, how much ribbon do I use?

Write $\frac{2}{3}$ of $5\frac{1}{4}$, or $\frac{2}{3}$ of $\frac{21}{4}$, in the form for canceling; that is, as

$$\frac{2 \times 21}{3 \times 4}.$$

The result is $3\frac{1}{2}$; that is, $3\frac{1}{2}$ yd.

$$\frac{\overset{\displaystyle 7}{\cancel{2} \times \cancel{21}}}{\underset{\displaystyle 2}{\cancel{3} \times \cancel{4}}} = \frac{7}{2} = 3\tfrac{1}{2}$$

MULTIPLYING BY A FRACTION

1. If you have $8\frac{1}{2}$ lb. of sugar and use $\frac{3}{4}$ of it, how many pounds do you use?

2. How much is $\frac{3}{8}$ of $7\frac{1}{2}$ lb. of sugar?

Find the value in each of the following cases:

3. $\frac{2}{3}$ of $6\frac{1}{2}$ in.	**7.** $\frac{1}{2}$ of $17\frac{3}{4}$ mi.	**11.** $\frac{1}{4}$ of $23\frac{1}{4}$ in.
4. $\frac{5}{8}$ of $3\frac{3}{4}$ ft.	**8.** $\frac{2}{3}$ of $25\frac{1}{2}$ mi.	**12.** $\frac{3}{4}$ of $15\frac{1}{2}$ yd.
5. $\frac{3}{4}$ of $5\frac{7}{8}$ in.	**9.** $\frac{1}{8}$ of $14\frac{1}{2}$ in.	**13.** $\frac{3}{8}$ of $20\frac{1}{4}$ yd.
6. $\frac{3}{8}$ of $4\frac{3}{4}$ yd.	**10.** $\frac{3}{8}$ of $21\frac{1}{2}$ lb.	**14.** $\frac{5}{8}$ of $15\frac{3}{4}$ mi.

15. On an automobile trip of $24\frac{1}{2}$ mi., how far have you gone when you have covered $\frac{5}{8}$ of the distance?

Find the value in each of the following cases:

16. $\frac{2}{3}$ of $\frac{5}{8}$ of 15 ft. **17.** $\frac{3}{8}$ of $\frac{2}{3}$ of $48\frac{1}{2}$ ft.

Multiplying a Mixed Number by a Mixed Number. In knitting a scarf, if Mary knits $3\frac{1}{2}$ in. in 1 hr., how many inches can she knit in $2\frac{1}{2}$ hr.?

What do you do first?
What do you do next?
Then what do you do?
What is the result?

$$3\tfrac{1}{2} = \tfrac{7}{2} \qquad 2\tfrac{1}{2} = \tfrac{5}{2}$$
$$\tfrac{5}{2} \times \tfrac{7}{2} = \tfrac{35}{4} = 8\tfrac{3}{4}$$

To multiply a mixed number by a mixed number, reduce each to an improper fraction and multiply these fractions.

MULTIPLYING BY A MIXED NUMBER

Multiply as follows:

1. $1\frac{1}{2} \times 2\frac{1}{2}$.
2. $2\frac{1}{2} \times 3\frac{1}{2}$.
3. $3\frac{1}{2} \times 3\frac{1}{2}$.
4. $2\frac{1}{2} \times 2\frac{1}{4}$.
5. $2\frac{1}{2} \times 3\frac{3}{4}$.
6. $3\frac{1}{2} \times 1\frac{1}{3}$.
7. $3\frac{1}{2} \times 4\frac{2}{3}$.
8. $5\frac{1}{2} \times 1\frac{1}{8}$.
9. $3\frac{1}{2} \times 2\frac{5}{8}$.
10. $4\frac{1}{4} \times 2\frac{1}{8}$.
11. $3\frac{3}{4} \times 3\frac{3}{8}$.
12. $5\frac{3}{4} \times 7\frac{5}{8}$.
13. $2\frac{3}{4} \times 6\frac{7}{8}$.
14. $2\frac{1}{3} \times 6\frac{7}{8}$.
15. $3\frac{2}{3} \times 5\frac{7}{8}$.
16. $3\frac{1}{2} \times 2\frac{5}{6}$.
17. $2\frac{1}{3} \times 3\frac{5}{6}$.
18. $3\frac{2}{3} \times 4\frac{5}{6}$.
19. $2\frac{1}{2} \times 3\frac{1}{10}$.
20. $5\frac{1}{2} \times 4\frac{3}{10}$.
21. $3\frac{1}{2} \times 5\frac{7}{10}$.
22. $8\frac{1}{2} \times 2\frac{9}{10}$.
23. $3\frac{1}{3} \times 3\frac{9}{10}$.
24. $2\frac{2}{3} \times 2\frac{9}{10}$.
25. $3\frac{1}{4} \times 1\frac{3}{10}$.
26. $2\frac{3}{4} \times 3\frac{3}{10}$.
27. $3\frac{3}{4} \times 5\frac{7}{10}$.
28. $5\frac{3}{4} \times 6\frac{9}{10}$.
29. $3\frac{1}{8} \times 2\frac{9}{10}$.
30. $5\frac{7}{8} \times 3\frac{9}{10}$.
31. $3\frac{1}{2} \times 1\frac{1}{12}$.
32. $3\frac{1}{2} \times 3\frac{5}{12}$.
33. $2\frac{1}{4} \times 2\frac{1}{12}$.
34. $2\frac{3}{4} \times 3\frac{5}{12}$.
35. $3\frac{3}{4} \times 5\frac{7}{12}$.
36. $2\frac{1}{2} \times 1\frac{1}{16}$.
37. $3\frac{1}{2} \times 2\frac{3}{16}$.
38. $3\frac{1}{4} \times 2\frac{3}{16}$.
39. $4\frac{3}{4} \times 5\frac{5}{16}$.
40. $4\frac{3}{8} \times 4\frac{3}{8}$.
41. $2\frac{7}{8} \times 6\frac{7}{8}$.
42. $1\frac{1}{4} \times 3\frac{1}{12}$.

Sales Slips. In large stores the clerk who makes a sale is usually required to fill out a *sales slip*, which shows the details of the sale. In filling out these slips, the clerk frequently has to multiply with fractions, as is shown in this model form. A good clerk is able to do this work rapidly and accurately.

Clerk No. 37 Date Feb. 6 1928
Dept. J Am't Rec'd $45.00

$\frac{1}{2}$ yd	Velveteen @ 1.75		88
$4\frac{3}{8}$ yd	Summer silk @ .96	4	20
$11\frac{1}{2}$ yd	Trimming @ .75	8	63
		13	71

The symbol @, which is used in the model form, means "at" and refers to the price of 1 yd., 1 lb., or whatever other unit is used.

SALES SLIPS

Supposing that you are Clerk No. 81, make out sales slips for the following goods sold today:

1. $26\frac{1}{2}$ yd. silk @ \$1.75, 8 yd. cotton @ $37\frac{1}{2}$¢, $14\frac{1}{2}$ yd. madras @ 55¢. Amount received, \$60.

2. $5\frac{1}{2}$ yd. cheviot @ \$3.40, $6\frac{1}{2}$ yd. velveteen @ \$2.60, $5\frac{3}{8}$ yd. silk @ \$1.75. Amount received, \$50.

3. $8\frac{1}{4}$ yd. India linen @ 65¢, $4\frac{5}{8}$ yd. dimity @ 45¢, $12\frac{1}{8}$ yd. linen suiting @ \$1.20. Amount received, \$25.

4. $9\frac{1}{2}$ yd. linen @ 64¢, $4\frac{1}{8}$ yd. cheviot @ \$3.75, $12\frac{1}{2}$ yd. cotton @ 40¢. Amount received, \$30.

5. $3\frac{1}{2}$ yd. linen @ 72¢, $5\frac{1}{2}$ yd. ribbon @ 42¢, $2\frac{7}{8}$ yd. velvet @ \$3.20. Amount received, \$20.

6. In Exs. 1–5, how much change is due each customer?

III. REVIEW AND DRILL

MINIMUM ESSENTIALS

1. Write in words the numbers 4,201,702 and MDCVI.
2. Write in figures the number nineteen million six.
3. Add $3296 + 49,248 + 674 + 3462 + 58,779 + 6364$.
4. Add $\$38.75 + \$93.46 + \$7.75 + \$329.50 + \$4.36$.
5. Subtract \$98.78 from $\$942.65 + \$9.89$.
6. Multiply $997 + 53,095$ by 3278.
7. Multiply $\$69.30 + \$478.70$ by 964.
8. Divide $87,960 + 48,290$ by $70\frac{3}{4} + 179\frac{1}{4}$.
9. Divide 774,932 by 302, and 945,260 by 604.
10. Reduce to lowest terms: $\frac{6}{8}$, $\frac{12}{16}$, $\frac{16}{32}$, $\frac{18}{32}$, $\frac{24}{32}$, $\frac{32}{32}$.
11. How many fourths are there in 7? in $7\frac{1}{4}$? in $9\frac{3}{4}$?
12. Reduce $25\frac{3}{4}$ to fourths; to eighths.
13. Reduce to whole or to mixed numbers: $\frac{34}{2}$, $\frac{47}{4}$, $\frac{61}{8}$.
14. Find the value of $7\frac{1}{2} + \frac{1}{8} + 3\frac{3}{4} + 9\frac{3}{4} + 3\frac{5}{8} - \frac{1}{2}$.
15. From $9\frac{1}{4}$ in. take $3\frac{1}{2}$ in. + $4\frac{7}{8}$ in.
16. How many strips of molding 8 in. long can be cut from a strip 5 ft. long, and how much will be left over?

Multiply or divide as indicated:

17. 625×425.	21. $\frac{1}{2} \times \frac{3}{4}$.	25. $\frac{1}{2} \times \frac{3}{4} \times \frac{5}{8}$.
18. 772×996.	22. $2\frac{1}{2} \times 3\frac{1}{2}$.	26. $3\frac{1}{2} \times 2\frac{1}{2} \times 3\frac{1}{4}$.
19. $1728 \div 12$.	23. $3\frac{1}{2} \times 14\frac{7}{8}$.	27. $4\frac{1}{2} \times 3\frac{2}{3} \times 4\frac{3}{4}$.
20. $5184 \div 24$.	24. $4128 \div 32$.	28. $4\frac{1}{2} \times 3\frac{3}{4} \times 2\frac{5}{8}$.

PROBLEMS WITHOUT NUMBERS

All work oral

1. How do you subtract a number of two figures from one of three figures when the units' figure to be subtracted is larger than the units' figure above it, and the same is true of the figure in tens' place? Give your reasons.

2. How do you multiply by a number of three figures when the last two figures are zeros? Give your reasons.

3. How do you divide by a number of three figures when the last two figures are zeros? Give your reasons.

4. How do you find the square of a number? How do you find the cube of a number?

5. How do you cancel factors from the terms of a fraction? What are the advantages of cancellation? Upon what principle does cancellation depend?

6. If you know the cost of some land and the cost per acre, how do you find the number of acres?

7. If you know the weight of a cubic foot of water and the number of cubic feet of water in a cistern, how do you find the weight of the water in the cistern?

8. If you know one of two numbers and how much less it is than the other, how do you find the other number?

9. If a number has been divided by another and you are given the number divided and the result, how can you find the number by which it was divided?

10. If a ticket seller has a large number of quarters and dimes, how can he find their value in dollars?

PROBLEMS FOR COMPLETION

1. Ruth can buy a gingham play dress for $2.50 and a blouse for $2.75. She has $1.75. Complete the problem in any reasonable way, of which there are usually several, and solve it.

Complete each of the following problems and solve it:

2. Marion has $2 and wishes to buy some toys for her little brother and sister. The price of a box of alphabet blocks is $1; of a Teddy bear, $1.15; of a red ball, 30¢; of a rubber doll, 40¢; and of a box of paper dolls, 15¢.

3. Edwin has $1.50 to spend for toys. A toy dog costs 89¢; a mask, 30¢; a ball, 25¢; and a trumpet, 39¢.

4. A man takes his family on a 4-day automobile trip in which they plan to cover 548 mi. The first day they go 142 mi.; the second day, 131 mi.; the third day, $136\frac{3}{4}$ mi.

5. The expenses of a certain school last year amounted to $1883.15. This sum included four items: the teacher's salary, $146.90 for books and supplies, $139.50 for fuel and lights, and $96.75 for miscellaneous expenses.

6. A certain school is in session from a quarter before nine to noon, and from a quarter past one to a quarter before four.

7. A sweater which Ida wishes to knit takes $2\frac{3}{4}$ hanks of yarn. Another kind will take only $2\frac{1}{2}$ hanks.

8. Ruth needs $9\frac{3}{4}$ yd. of cloth which costs $1.20 a yard.

9. Our car uses 1 gal. of gasoline every 18 mi. Yesterday we drove 156 mi.

MISCELLANEOUS PROBLEMS

1. If John picks on an average $3\frac{3}{4}$ qt. of raspberries in an hour, how many quarts of berries does he pick in 2 hr.?

2. If Elizabeth picks 3 qt. of raspberries per hour, how many quarts of berries does she pick in $2\frac{1}{4}$ hr.?

3. The width of a certain rectangle is known to be $\frac{3}{4}$ of the length. If the length of the rectangle is 64 in., what is the width?

4. To make $2\frac{1}{2}$ times a recipe, which calls for 2 cups of milk, how many cups of milk must you use?

5. If it takes $2\frac{5}{8}$ yd. of cloth to make a boy's suit, how many yards will it take to make a dozen such suits?

6. When a tin cup which holds $\frac{15}{16}$ pt. is $\frac{2}{3}$ full, what part of a pint is there in the cup?

7. If a glass jar holds $\frac{15}{16}$ qt. of preserves, what part of a quart will it contain when $\frac{4}{5}$ full? What part of a quart will it contain when $\frac{2}{5}$ full? when $\frac{3}{5}$ full?

8. How long will it take an airplane that is traveling at the rate of 1 mi. in 27 sec. (1 mi. in $\frac{27}{60}$ min.) to go 5 mi.? to go $9\frac{1}{2}$ mi.? to go $10\frac{1}{2}$ mi.?

9. A dressmaker bought $8\frac{3}{4}$ yd. of silk @ \$2.60, $6\frac{5}{8}$ yd. of voile @ 75¢, $3\frac{1}{2}$ yd. of fancy lining @ \$1.85, and $5\frac{1}{4}$ yd. of braid @ $37\frac{1}{2}$¢. How much did it all cost?

PROBLEMS IN THRIFT

1. Mrs. Johnson finds that her cook is wasting one slice of bread every day. If a loaf of bread is cut into 16 slices, in how many days will she waste 3 loaves of bread?

2. If Mrs. Wallace buys potatoes during the winter, she pays $2 a bushel for them. In the fall she can buy them for $1.10 a bushel. Find how much she saves by buying 10 bu. in the fall.

3. Mrs. Brown decided to save money by buying groceries in larger quantities. She made a list showing what the grocer charged for certain goods when bought in quantity and the prices she paid when buying by the pound or by the can. If she could use the larger amounts, find how much she could save on the following order:

Bacon, piece of 8 lb., $3.20; 45¢ per pound
Canned corn, case of 24 cans, $3.60; 18¢ per can
Crackers, box of 7 lb., $1.40; 23¢ per pound
Soap, box of 100 bars, $8.75; 10¢ per bar

4. By using a fireless cooker, Mrs. Brown reduced her gas bills for January, February, and March from a total of $8.95 for these months in the previous year to $7.25. At this rate, how much will Mrs. Brown save if she uses the fireless cooker throughout the year?

5. In July a coal dealer told Mr. Field that he could buy his winter's coal for $11.60 a ton. Mr. Field waited, however, until October, and then had to pay $12.85 a ton for the 16 T. which he needed. How much could he have saved on his coal bill by buying in July?

IV. LITTLE EXAMINATIONS

I. 1. MDCXXXI = (?).
2. $742,982 - 638,863$.
3. $702\frac{1}{8} + 338\frac{3}{4}$.
4. $901\frac{3}{4} - 348\frac{7}{8}$.
5. $72 \times 3\frac{7}{8}$.
6. $57\frac{1}{2} \times 140$.
7. $\frac{3}{8} \times \frac{3}{4}$.
8. $2\frac{1}{8} \times 4\frac{1}{2}$.

II. 1. MDXCVI = (?).
2. $877,859 + 358,583$.
3. $700,203 - 386,774$.
4. $6076 \times 48,305$.
5. $3\frac{1}{2} + 2\frac{7}{8}$.
6. $3\frac{1}{2} - 2\frac{7}{8}$.
7. $3\frac{1}{2} \times 2\frac{7}{8}$.
8. $5\frac{3}{8} \times 9\frac{7}{10}$.

III. 1. MCCXCVI = (?).
2. $229,628 + 69,837$.
3. $402,120 - 36,879$.
4. $7008 \times 82,635$.
5. $72 + 9\frac{7}{8}$.
6. $72 - 9\frac{7}{8}$.
7. $72 \times 9\frac{7}{8}$.
8. $9\frac{7}{8} \times 72\frac{1}{2}$.

IV. 1. CLXXXIV = (?).
2. $893,434 + 98,877$.
3. $911,034 - 38,048$.
4. $489 \times \$662.75$.
5. $15 \times 14\frac{3}{8}$.
6. $15\frac{1}{2} + 14\frac{3}{8}$.
7. $15\frac{1}{2} - 14\frac{3}{8}$.
8. $15\frac{1}{2} \times 14\frac{3}{8}$.

V. 1. Reduce $8\frac{2}{3}$ to thirds.
2. $8\frac{1}{2} + 3\frac{3}{8} + 2\frac{1}{4}$.
3. $4\frac{7}{8} + 8\frac{3}{4} + 2\frac{1}{2}$.
4. $702\frac{1}{8} - 338\frac{3}{4}$.
5. $\frac{5}{8} + \frac{3}{8} + 2\frac{1}{4}$.
6. $3\frac{3}{4} + \frac{1}{2} - \frac{1}{8}$.
7. $8\frac{3}{4} + 3\frac{1}{2}$.
8. $33\frac{2}{5} \times 18\frac{3}{8}$.

VI. 1. Reduce $\frac{25}{5}$ to units.
2. $7\frac{3}{4} + 6\frac{3}{4} + 4\frac{7}{8}$.
3. $3\frac{2}{3} + 8\frac{3}{4} - 7\frac{1}{2}$.
4. $901\frac{3}{4} + 348\frac{7}{8}$.
5. $\$64.96 \div 8$.
6. $8\frac{3}{8}$ ft. + $6\frac{7}{16}$ ft.
7. $9\frac{3}{8}$ in. − $2\frac{1}{2}$ in.
8. $79\frac{1}{2} \times 121\frac{3}{4}$.

CHAPTER II

I. FRACTIONS

DIVIDING BY A WHOLE NUMBER

All work oral

State the answers in each of the following cases:

1. 9 in. ÷ 3, and $\frac{9}{32} \div 3$.

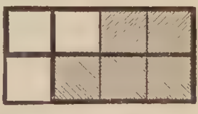
2. 15 in. ÷ 5, and $\frac{15}{16} \div 5$.

3. 21 yd. ÷ 7, and $\frac{21}{32} \div 7$.

4. 25 qt. ÷ 5, and $\frac{25}{32} \div 5$.

5. Dividing the numerator of a fraction by a whole number does what to the value of the fraction?

6. If you divide $\frac{1}{2}$ of this rectangle into two equal parts, each is what part of the rectangle? How much is $\frac{1}{2} \div 2$?



7. If you divide $\frac{3}{4}$ of the rectangle into two equal parts, how many eighths of the rectangle do you have? How much is $\frac{3}{4} \div 2$? What have you done to the denominator?

8. Multiplying the denominator of a fraction by a whole number does what to the value of the fraction?

By dividing the numerator, divide as follows:

9. $\frac{2}{3} \div 2$. **10.** $\frac{18}{16} \div 3$. **11.** $\frac{5}{8} \div 5$. **12.** $\frac{15}{32} \div 5$.

By multiplying the denominator, divide as follows:

13. $\frac{1}{2} \div 3$. **14.** $\frac{2}{3} \div 5$. **15.** $\frac{3}{4} \div 4$. **16.** $\frac{3}{5} \div 2$.

Dividing Fractions. The following examples show how we divide a fraction by a whole number:

1. Divide $\frac{4}{7}$ by 2.

Simply divide the numerator of the fraction by 2, the denominator remaining unchanged.

In dividing a fraction by a whole number, always divide the numerator, if it is exactly divisible, instead of multiplying the denominator. It shortens the work!

$$\boxed{\frac{4 \div 2}{7} = \frac{2}{7}}$$

2. Divide $\frac{5}{8}$ by 3.

Simply multiply the denominator by 3, the numerator remaining unchanged, as shown in the work at the right.

$$\boxed{\frac{5}{3 \times 8} = \frac{5}{24}}$$

3. Divide $\frac{15}{16}$ by 10.

Indicate the multiplication of the denominator and cancel, as shown.

This is shorter than to multiply the denominator before canceling. It saves time and avoids errors!

$$\boxed{\frac{\overset{3}{\cancel{15}}}{\underset{2}{\cancel{10}} \times 16} = \frac{3}{32}}$$

4. Divide $45\frac{1}{3}$ by 3.

Since 45 is exactly divisible by 3, we have $45 \div 3 = 15$, and $\frac{1}{3} \div 3 = \frac{1}{9}$, which is shorter than first reducing $45\frac{1}{3}$ to $\frac{136}{3}$.

$$\boxed{\frac{45\frac{1}{3}}{3} = 15\frac{1}{9}}$$

5. Divide $244\frac{1}{2}$ by 3.

First reduce $244\frac{1}{2}$ to the improper fraction $\frac{489}{2}$. Then divide the numerator by 3, since it is exactly divisible, and reduce the result as here shown.

$$\boxed{\begin{aligned} \frac{244\frac{1}{2}}{3} &= \frac{489 \div 3}{2} \\ &= \frac{163}{2} \\ &= 81\tfrac{1}{2} \end{aligned}}$$

DIVIDING BY A WHOLE NUMBER

1. To make a certain quantity of fudge, Mary's cook-book tells her to divide $\frac{1}{2}$ lb. of chocolate into 3 equal parts. What part of a pound is there in each part?

2. Clara's mother buys $13\frac{1}{8}$ yd. of cloth with which to make 5 children's dresses. How many yards of cloth should she allow for making each dress?

3. A sewing club needs $6\frac{3}{4}$ yd. of flannel for making 4 long wrappers for babies. How much flannel should be allowed for making each wrapper?

4. If a girl can knit 4 in. on a sweater sleeve in $1\frac{1}{4}$ hr., what part of an hour does it take to knit 1 in.?

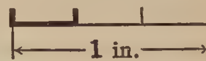
5. Helen finds that she uses 1 lb. 9 oz., or $1\frac{9}{16}$ lb., of wool in knitting 5 socks. What part of a pound does she use for 1 sock? for a pair of socks?

6. If an automobile goes $67\frac{1}{2}$ mi. in 3 hr., what is the average distance traveled per hour?

Divide as follows:

7. $\frac{1}{2} \div 2.$	**15.** $\frac{1}{3} \div 2.$	**23.** $\frac{1}{4} \div 2.$	**31.** $27\frac{1}{2} \div 3.$
8. $\frac{1}{2} \div 3.$	**16.** $\frac{2}{3} \div 2.$	**24.** $\frac{1}{4} \div 3.$	**32.** $29\frac{1}{2} \div 2.$
9. $\frac{2}{5} \div 2.$	**17.** $\frac{4}{5} \div 2.$	**25.** $\frac{1}{8} \div 2.$	**33.** $36\frac{3}{5} \div 3.$
10. [illegible] 2.	**18.** $\frac{5}{8} \div 3.$	**26.** $\frac{7}{8} \div 3.$	**34.** $28\frac{1}{8} \div 9.$
11. $\frac{3}{5} \div 3.$	**19.** $\frac{5}{8} \div 4.$	**27.** $\frac{7}{8} \div 4.$	**35.** $24\frac{4}{5} \div 4.$
12. $\frac{4}{5} \div 2.$	**20.** $\frac{3}{8} \div 4.$	**28.** $\frac{7}{8} \div 7.$	**36.** $28\frac{3}{4} \div 5.$
13. $\frac{3}{8} \div 3.$	**21.** $\frac{3}{8} \div 6.$	**29.** $\frac{5}{8} \div 5.$	**37.** $75\frac{15}{16} \div 5.$
14. $\frac{3}{4} \div 2.$	**22.** $\frac{8}{5} \div 4.$	**30.** $\frac{3}{4} \div 9.$	**38.** $134\frac{1}{2} \div 5.$

Dividing by a Unit Fraction. How many thirds of an inch are there in 1 in.? Then $1 \div \frac{1}{3}$ is how many? Compare the values of $1 \div \frac{1}{3}$ and 1×3.



In the same way, what can you say about the values of $3 \div \frac{1}{2}$ and 3×2?

What can you say about the values of $\frac{3}{4} \div \frac{1}{3}$ and $\frac{3}{4} \times 3$?

To divide a number by a unit fraction, multiply the number by the denominator of the fraction.

Thus, $1 \div \frac{1}{8} = 1 \times 8 = 8,$

$3 \div \frac{1}{8} = 3 \times 8 = 24,$

and $\frac{3}{4} \div \frac{1}{8} = \frac{3}{4} \times 8 = 6.$

DIVIDING BY A UNIT FRACTION

1. If a sheet of veneer is $\frac{1}{16}$ in. thick, how many sheets are needed to make a total thickness of 1 in.? of 2 in.? of $\frac{3}{16}$ in.? of $\frac{5}{8}$ in.?

2. If a sheet of cardboard is $\frac{1}{32}$ in. thick, how many sheets are there in a pile that is $12\frac{7}{8}$ in. high?

3. If a wagon wheel makes $\frac{1}{12}$ of a revolution in going 1 ft., how many feet will it go in making 144 revolutions?

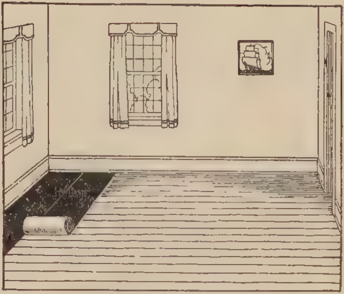
Divide as follows:

4. $32 \div \frac{1}{8}$.	9. $\frac{5}{6} \div \frac{1}{3}$.	14. $2\frac{2}{5} \div \frac{1}{5}$.	19. $2\frac{3}{4} \div \frac{1}{24}$.
5. $24 \div \frac{1}{16}$.	10. $\frac{1}{2} \div \frac{1}{2}$.	15. $3\frac{5}{8} \div \frac{1}{8}$.	20. $3\frac{2}{3} \div \frac{1}{24}$.
6. $15 \div \frac{1}{12}$.	11. $\frac{3}{4} \div \frac{1}{4}$.	16. $4\frac{3}{4} \div \frac{1}{12}$.	21. $5\frac{7}{8} \div \frac{1}{32}$.
7. $24 \div \frac{1}{12}$.	12. $\frac{7}{8} \div \frac{1}{8}$.	17. $7\frac{3}{8} \div \frac{1}{16}$.	22. $2\frac{5}{8} \div \frac{1}{64}$.
8. $36 \div \frac{1}{16}$.	13. $\frac{4}{5} \div \frac{1}{5}$.	18. $5\frac{3}{16} \div \frac{1}{16}$.	23. $3\frac{7}{8} \div \frac{1}{64}$.

DIVIDING BY A FRACTION

All work oral

1. If you wish to find how many strips of carpet $\frac{3}{4}$ yd. wide are needed to cover the floor of a room 18 ft. wide, you must first find how many yards there are in 18 ft. How many yards are there?



2. If you have to divide 6 yd. by $\frac{3}{4}$ yd., you may think of the 6 yd. as fourths of a yard. Express 6 as fourths.

3. In dividing $\frac{24}{4}$ by $\frac{3}{4}$, think of the cases of 24¢ ÷ 3¢ and 24 in. ÷ 3 in. What are the results in these cases?

4. Then how much is $\frac{24}{4} \div \frac{3}{4}$? How many strips of carpet do you need to cover the floor mentioned in Ex. 1?

5. Divide $\frac{6}{5}$ by $\frac{2}{5}$. Multiply $\frac{6}{5}$ by $\frac{5}{2}$.

6. Show that $\frac{4}{5} \div \frac{2}{5}$ gives the same result as $\frac{4}{5} \times \frac{5}{2}$.

7. Study the following examples:

$$15 \div \frac{3}{5} = \overset{5}{\cancel{15}} \times \frac{5}{\cancel{3}} = 25 \qquad \frac{3}{8} \div \frac{5}{16} = \frac{3}{\cancel{8}} \times \frac{\overset{2}{\cancel{16}}}{5} = \frac{6}{5} = 1\tfrac{1}{5}$$

Divide as follows:

8. $2 \div \frac{2}{3}$.	12. $9 \div \frac{3}{4}$.	16. $\frac{7}{8} \div \frac{7}{8}$.	20. $\frac{5}{3} \div \frac{2}{3}$.
9. $3 \div \frac{3}{4}$.	13. $15 \div \frac{5}{4}$.	17. $5 \div \frac{1}{2}$.	21. $\frac{3}{5} \div \frac{2}{3}$.
10. $6 \div \frac{3}{8}$.	14. $21 \div \frac{7}{8}$.	18. $5 \div \frac{2}{3}$.	22. $\frac{3}{5} \div \frac{3}{2}$.
11. $5 \div \frac{5}{8}$.	15. $10 \div \frac{5}{8}$.	19. $5 \div \frac{3}{4}$.	23. $\frac{2}{3} \div \frac{3}{5}$.

Dividing by a Fraction. From page 109 we have the rule,

To divide by a fraction multiply by the fraction inverted.

That is, $\frac{3}{4} \div \frac{2}{3} = \frac{3}{4} \times \frac{3}{2} = \frac{9}{8} = 1\frac{1}{8}$,

and
$$2\tfrac{5}{8} \div \frac{3}{4} = \frac{\overset{7}{\cancel{21}}}{\underset{2}{\cancel{8}}} \times \frac{\cancel{4}}{\cancel{3}} = \frac{7}{2} = 3\tfrac{1}{2}.$$

DIVIDING BY A FRACTION

In Exs. 1–16 first divide as indicated, and then divide the second fraction by the first:

1. $\frac{7}{8} \div \frac{2}{3}$.
2. $\frac{5}{6} \div \frac{3}{4}$.
3. $\frac{3}{8} \div \frac{5}{6}$.
4. $\frac{5}{8} \div \frac{1}{5}$.
5. $\frac{5}{8} \div \frac{3}{5}$.
6. $\frac{3}{8} \div \frac{3}{4}$.
7. $\frac{3}{4} \div \frac{5}{8}$.
8. $\frac{5}{6} \div \frac{5}{8}$.
9. $\frac{9}{10} \div \frac{4}{5}$.
10. $\frac{5}{12} \div \frac{7}{8}$.
11. $\frac{3}{8} \div \frac{5}{12}$.
12. $\frac{7}{16} \div \frac{3}{32}$.
13. $\frac{5}{64} \div \frac{7}{32}$.
14. $\frac{3}{8} \div \frac{5}{16}$.
15. $\frac{3}{40} \div \frac{6}{25}$.
16. $\frac{7}{48} \div \frac{7}{12}$.

17. Divide 6 by $\frac{1}{2}$. How many half-yard pieces can be cut from 6 yd. of ribbon? from 14 yd. of ribbon?

18. If a recipe for cake calls for $\frac{1}{2}$ lb. of sugar, $6\frac{1}{2}$ lb. of sugar is enough for how many times as much cake?

19. How many towels, each requiring $\frac{5}{8}$ yd. of toweling, can be made from a piece $11\frac{7}{8}$ yd. long?

20. How many jelly glasses holding $\frac{1}{2}$ pt. each does Alice's mother need for 8 qt. of jelly?

21. How many bottles holding $\frac{7}{8}$ qt. each does Alice's mother need for 14 qt. of sirup?

22. How many mats, each $\frac{3}{4}$ yd. long, can be made from a strip of carpet 15 yd. long?

Dividing by a Mixed Number. In dividing by a mixed number, simply write the mixed number as a fraction, invert it, and multiply.

For example, suppose that you wish to divide $4\frac{2}{3}$ by $2\frac{4}{5}$.

In this case write both mixed numbers as fractions, invert the second one, as here shown, and cancel.

$$4\tfrac{2}{3} \div 2\tfrac{4}{5} = \tfrac{14}{3} \div \tfrac{14}{5} = \frac{\cancel{14}}{3} \times \frac{5}{\cancel{14}} = \tfrac{5}{3} = 1\tfrac{2}{3}$$

The improper fraction $\frac{5}{3}$ is then reduced to the mixed number $1\frac{2}{3}$.

DIVIDING BY A MIXED NUMBER

1. Divide $48\frac{3}{8}$ by $5\frac{3}{8}$. How many strips of cloth, each $5\frac{3}{8}$ yd. long, can you cut from a strip $48\frac{3}{8}$ yd. long?

2. How many strips of ribbon, each $2\frac{3}{4}$ yd. long, can be cut from a piece of ribbon that is $13\frac{3}{4}$ yd. long?

3. At $66\frac{2}{3}$¢ a yard, how many yards of cloth can be bought for \$8? for \$17? for \$36?

Divide as follows:

4. $5 \div 2\frac{1}{2}$.
5. $3 \div 1\frac{1}{2}$.
6. $3 \div 2\frac{1}{2}$.
7. $4\frac{1}{2} \div 1\frac{1}{2}$.
8. $4\frac{1}{2} \div 2\frac{1}{4}$.
9. $5\frac{1}{2} \div 2\frac{3}{4}$.
10. $7\frac{1}{2} \div 2\frac{1}{2}$.
11. $7 \div 3\frac{3}{8}$.
12. $2 \div 3\frac{1}{4}$.
13. $3 \div 3\frac{1}{2}$.
14. $5 \div 2\frac{2}{3}$.
15. $2 \div 5\frac{1}{3}$.
16. $28 \div 4\frac{2}{3}$.
17. $46 \div 3\frac{5}{6}$.
18. $2\frac{1}{8} \div 3\frac{1}{16}$.
19. $4\frac{3}{16} \div 3\frac{3}{8}$.
20. $3\frac{3}{8} \div 4\frac{3}{16}$.
21. $16\frac{4}{5} \div 4\frac{1}{5}$.
22. $15\frac{1}{3} \div 3\frac{5}{6}$.
23. $17\frac{1}{2} \div 2\frac{1}{2}$.
24. $9\frac{7}{12} \div 5\frac{3}{4}$.

Relations of Numbers. Suppose that 3 lemons cost 10¢. How much will 1 doz. lemons cost? That is, the cost of 1 doz. is how many times the cost of 3 lemons? What is the final result? How did you find it?

Could you have given the answer by first finding the cost of 1 lemon and then multiplying it by 12? Would this have been a better method than the one suggested above? State your reasons.

RELATIONS OF NUMBERS

All work oral

1. If 4 bananas cost 15¢, how much will 1 doz. cost?

2. If you can buy 5 apples for a quarter, how much must you pay for 10 apples? for 15 apples?

3. At 3 collars for 50¢, how much must John pay for $\frac{1}{2}$ doz. collars? for 9 collars? for 2 doz. collars?

4. At 4 cans for 70¢, how much must Mrs. Reed pay for 8 cans of tomatoes? for 1 doz. cans? for $1\frac{1}{2}$ doz. cans?

5. If you can buy tennis balls at the rate of 3 for $1, how much must you pay for $\frac{1}{2}$ doz.? for 9? for a dozen?

In each of the following pairs of numbers state how many times as large as the second the first is:

6. 20, 5.	**10.** 35, 5.	**14.** 40, 10.	**18.** 60, 30.
7. 20, $2\frac{1}{2}$.	**11.** 35, $2\frac{1}{2}$.	**15.** 40, 20.	**19.** 60, $7\frac{1}{2}$.
8. 20, $1\frac{1}{4}$.	**12.** 35, $1\frac{1}{4}$.	**16.** 50, 25.	**20.** 80, $\frac{1}{2}$.
9. 30, $7\frac{1}{2}$.	**13.** 35, $3\frac{1}{2}$.	**17.** 40, $2\frac{1}{2}$.	**21.** 70, $3\frac{1}{2}$.

Fractional Parts. If a baseball team plays 28 games and wins 16 of them, what fraction of the games does it win?

Here we wish to find what fraction 16 is of 28.

Just as 1 is $\frac{1}{2}$ of 2, and 2 is $\frac{2}{4}$ of 4, so

$$16 \text{ is } \tfrac{16}{28}, \text{ or } \tfrac{4}{7}, \text{ of } 28.$$

That is, the team wins $\frac{4}{7}$ of the games played.

To find what fraction the first of two numbers is of the second, divide the first number by the second.

FINDING FRACTIONAL PARTS

Numbers 1 to 6, oral

1. There are 20 girls in a class of 40 pupils. The girls are what fraction of the class?

2. After walking 2 mi. on a hike of 6 mi., a troop of Boy Scouts has walked what part of the total distance?

Find what fraction the first of these numbers is of the second:

3. 5, 15. **4.** 8, 24. **5.** 16, 32. **6.** 12, 18.

7. When you have gone 30 mi. on a railway journey of 240 mi., what part of the journey have you finished?

8. In Ex. 7, what part of the journey have you finished when you have gone 60 mi.? 80 mi.? 120 mi.?

Find what fraction the first of these numbers is of the second:

9. 35, 140. **12.** \$90, \$270. **15.** 27 in., 54 in.

10. 62, 310. **13.** \$85, \$340. **16.** 17 ft., 68 ft.

11. 45, 360. **14.** \$67, \$335. **17.** 19 ft., 133 ft.

USING WHAT YOU HAVE LEARNED

1. Martha has $\frac{3}{4}$ yd. of lace and needs $\frac{3}{8}$ yd. for trimming a waist. What part of the $\frac{3}{4}$ yd. does she need?

2. Anna has $2\frac{1}{2}$ yd. of velvet and needs $\frac{5}{8}$ yd. of it for trimming a hat. What part of the velvet does she need?

Find what part the first of these numbers is of the second:

3. $\frac{2}{3}$, $\frac{3}{4}$.	6. $\frac{1}{16}$, $\frac{3}{8}$.	9. $1\frac{1}{2}$, $4\frac{1}{2}$.	12. $16\frac{2}{3}$, $66\frac{2}{3}$.
4. $\frac{3}{4}$, $\frac{7}{8}$.	7. $\frac{3}{16}$, $\frac{5}{8}$.	10. $2\frac{2}{3}$, 4.	13. $14\frac{1}{6}$, $42\frac{1}{2}$.
5. $\frac{2}{5}$, $\frac{3}{4}$.	8. $\frac{5}{16}$, $\frac{7}{8}$.	11. $3\frac{5}{8}$, $4\frac{5}{6}$.	14. $16\frac{2}{3}$, $22\frac{1}{2}$.

Reduce to lowest terms these fractions found in divisions:

15. $\frac{30}{45}$. 16. $\frac{90}{120}$. 17. $\frac{105}{120}$. 18. $\frac{90}{288}$. 19. $\frac{225}{400}$.

20. Frank is 12 yr. old and his brother is 18 yr. old. Six years ago Frank's age was what part of his brother's? Six years from now it will be what part?

By canceling common factors, as in the case of ordinary fractions, reduce the following to lowest terms:

21. $\dfrac{7 \times 21 \times 77 \times 6}{49 \times 33 \times 42}$.

22. $\dfrac{20 \times 25 \times 36 \times 48}{27 \times 40 \times 15 \times 12}$.

23. $\dfrac{32 \times 27 \times 44 \times 39}{55 \times 72 \times 36 \times 8 \times 3}$.

24. $\dfrac{125 \times 108 \times 51 \times 8}{40 \times 45 \times 85 \times 12 \times 3}$.

By reducing to improper fractions, and by using cancellation as in Exs. 21–24, multiply as follows:

25. $13\frac{1}{3} \times 32\frac{1}{5} \times 16\frac{7}{8}$.

26. $27\frac{1}{5} \times 24\frac{1}{2} \times 37\frac{1}{2}$.

27. $42\frac{2}{3} \times 66\frac{2}{3} \times 74\frac{1}{4}$.

28. $7\frac{3}{5} \times 2\frac{1}{7} \times 5\frac{1}{4} \times 21\frac{1}{3}$.

REVIEW OF FRACTIONS

Add as follows:

1. $\frac{1}{2} + \frac{1}{2}$.
2. $\frac{1}{2} + \frac{1}{3}$.
3. $2\frac{1}{2} + 2\frac{1}{2}$.
4. $2\frac{1}{2} + 3\frac{1}{3}$.
5. $2\frac{1}{4} + 3\frac{3}{8}$.
6. $3\frac{1}{3} + 3\frac{2}{3}$.
7. $2\frac{3}{4} + 3\frac{2}{3}$.
8. $3\frac{5}{6} + 3\frac{2}{3}$.

Subtract as follows:

9. $\frac{7}{8} - \frac{1}{2}$.
10. $\frac{1}{3} - \frac{1}{4}$.
11. $3\frac{3}{8} - 2\frac{1}{2}$.
12. $7\frac{3}{4} - 4\frac{2}{5}$.
13. $5\frac{2}{3} - 3\frac{1}{2}$.
14. $2\frac{2}{3} - 1\frac{7}{8}$.
15. $7\frac{3}{4} - 4\frac{7}{8}$.
16. $6\frac{1}{2} - 3\frac{7}{8}$.

Multiply as follows:

17. $3 \times 3\frac{1}{3}$.
18. $2 \times 3\frac{7}{8}$.
19. $2\frac{3}{4} \times 8$.
20. $2\frac{1}{3} \times 3\frac{1}{3}$.
21. $2\frac{3}{8} \times 3\frac{1}{2}$.
22. $3\frac{1}{3} \times 4\frac{1}{2}$.
23. $3\frac{7}{8} \times 2\frac{1}{2}$.
24. $2\frac{1}{2} \times 4\frac{1}{4}$.

Divide as follows:

25. $\frac{5}{8} \div \frac{1}{5}$.
26. $\frac{2}{3} \div \frac{1}{3}$.
27. $2\frac{5}{8} \div \frac{3}{4}$.
28. $2 \div \frac{2}{3}$.
29. $5\frac{2}{3} \div 4\frac{2}{3}$.
30. $\frac{3}{4} \div 3\frac{1}{2}$.
31. $2\frac{3}{8} \div 2\frac{3}{4}$.
32. $3\frac{5}{8} \div 1\frac{1}{8}$.

33. Allowing $3\frac{3}{8}$ yd. to a suit of clothes, how many suits can be made from a roll of cloth containing 108 yd.?

34. To divide a sheet of paper $7\frac{7}{8}$ in. wide into 4 equal columns, what distance must be spaced off for each one?

35. After Edith has walked $\frac{3}{4}$ mi., she has gone $\frac{3}{8}$ of the way to Ida's house. Find the distance to Ida's house.

Copy and complete these statements:

36. The expression "$\frac{2}{3} \times$" means to multiply by —— and divide by ——.

37. The expression "$\div \frac{2}{3}$" means to multiply by —— and divide by ——.

REVIEW PROBLEMS

1. In School No. 17 there were recently 265 children in the kindergarten. If $\frac{3}{5}$ of them were boys, how many boys were there?

2. Ben's big brother Tom used 13 gal. of gasoline to drive his truck from Boston to Hartford, a distance of 143 mi. At this rate, how far could he go on $17\frac{1}{2}$ gal.?

3. Before he moved to the farm Ben sold newspapers. He made $\frac{1}{2}$¢ on each paper. How much did he make in a week in which he sold 336 papers?

4. If it costs Helen 20¢ per week to buy cabbage for 3 rabbits, how much will it cost to feed 18 rabbits?

5. Last summer at the lake it took us 3 hr. to go 25 mi. in Mr. Clark's motor boat. At that rate, how long would it take us to go $37\frac{1}{2}$ mi.?

6. If the distance around the outside of an automobile tire is $8\frac{2}{3}$ ft., how many times must it turn to go 1 mi.?

7. If you pay 75¢ for 30 lb. of potatoes, how much must you pay for 50 lb.?

8. Mr. Clark paid $16.80 for gasoline and oil for his motor boat. If $\frac{1}{6}$ of this amount was for oil, what was the cost of the oil? of the gasoline?

9. How many boxes holding $\frac{3}{4}$ lb. each can be filled from 9 lb. of candy?

10. If $\frac{3}{4}$ lb. of cheese costs 30¢, how much do 3 lb. cost?

11. Find the cost of $3\frac{1}{4}$ bu. of potatoes @ $1.20, $2\frac{1}{2}$ qt. of milk @ 14¢, $4\frac{1}{2}$ doz. eggs @ 60¢, and $5\frac{1}{2}$ lb. of meat @ 32¢.

II. DECIMALS

A SILENT READING LESSON

We have already learned that \$3.25 means 3 dollars and 25 cents, which is the same as $\$3 + \$\frac{25}{100}$, or $\$3\frac{1}{4}$.

From this we see that a length of 3.25 ft. must mean a length of 3 ft. + $\frac{25}{100}$ ft., or $3\frac{1}{4}$ ft.

In writing \$3.25 we place the decimal point between the dollars and the fraction of a dollar, and in writing 3.25 ft. we place the decimal point between the feet and the fraction of a foot.

If on a time-table a certain place is given as 148.75 mi. from Seattle, we know that the distance is $148\frac{3}{4}$ mi. That is, if we wish to write $2\frac{3}{4}$ mi. without using the fraction $\frac{3}{4}$, we may write it as 2.75 mi.

From the cases above we see that

4.75 in. means 4 in. + $\frac{75}{100}$ in., or $4\frac{3}{4}$ in.;
2.5 means $2 + \frac{5}{10}$, or $2\frac{1}{2}$;
0.5 (or .5) means $\frac{5}{10}$, $\frac{50}{100}$, 0.50, or $\frac{1}{2}$;
0.06 (or .06) means $\frac{6}{100}$, or $\frac{3}{50}$;
and 0.125 (or .125) means $\frac{125}{1000}$, or $\frac{1}{8}$.

We may write either 0.5 or .5 for five tenths, but we shall be more certain to notice the decimal point if we write 0.5.

We see that one decimal place means tenths, two decimal places mean hundredths, and three decimal places mean thousandths.

Similarly, tenths mean one decimal place, hundredths mean two decimal places, and thousandths mean three decimal places.

A LITTLE WRITING LESSON

Copy the following, filling in the blank spaces:

1. The fraction $\frac{1}{2}$ is called a *common* ——, or simply a *fraction*, and the fraction 0.5 is called a *decimal fraction*, or simply a *decimal*. The usual way of writing one half is ——, but the decimal way of writing it is 0.5.

2. As a common fraction, three tenths is written $\frac{3}{10}$; as a decimal, it is written as 0.3. As a common fraction, three hundredths is written $\frac{3}{100}$; as a decimal, it is written as ——.

3. The decimals 0.5, 0.75, and 0.05 may be written as common fractions; that is, $0.5 = \frac{5}{10}$, or $\frac{1}{2}$; 0.75 = ——, or $\frac{\ }{4}$; and 0.05 = ——, or ——.

4. The first place to the right of the decimal point is called tenths, the second decimal place is called ——, the third —— —— is called thousandths, and the —— decimal place is called ten-thousandths.

5. The common business way of reading the decimal 1.37 is "one point three-seven" or "one and thirty-seven ——," and 32.43 may be read "—— —— point —— ——," or it may be read "—— and —— ——."

Write both the common fraction and the decimal for

6. Four tenths.
7. Six tenths.
8. Seven tenths.
9. Nine tenths.
10. Five hundredths.
11. Seven hundredths.
12. Twenty-five hundredths.
13. Sixty-two hundredths.

A SILENT READING LESSON

The names of the decimal places that are most frequently used are shown in the following illustration:

Thousands	Hundreds	Tens	Units	(Decimal point)	Tenths	Hundredths	Thousandths
8	2	0	5	.	3	7	5

This number is read "eight thousand two hundred five *and* three hundred seventy-five thousandths," or "eight-two-o-five point three-seven-five."

The places beyond thousandths are ten-thousandths, hundred-thousandths, millionths, and so on.

In a decimal the denominator is shown by the position of the decimal point. Thus, 0.9 is nine tenths, the point indicating that the denominator is 10. Similarly, 0.25 is twenty-five hundredths, and 0.05 is five hundredths.

In writing decimals, write only the numerator of the fraction, inserting such zeros as may be necessary to indicate the denominator, and place the decimal point before the tenths.

Thus, the number two hundred four thousandths in figures is .204, or, as usually written, it is 0.204. Similarly, the number seventeen thousandths is 0.017.

READING AND WRITING DECIMALS

Numbers 1 to 35, oral

Read the following statements and tell the meaning of each:

1. On a motor trip Ethel went 102.7 mi. in one day.

2. The average height of the boys in our class is 55.2 in.

3. The average lifting power of the boys in our class is 52.9 lb. for the right forearm and 48.5 lb. for the left.

4. Cork is 0.24 times as heavy as water and granite is 2.78 times as heavy as water.

Read the following numbers:

5. 0.1.	11. 5.6.	17. 0.15.	23. 2.25.	29. 7.125.
6. 0.3.	12. 0.9.	18. 2.15.	24. 4.10.	30. 5.712.
7. 0.7.	13. 2.9.	19. 7.15.	25. 5.50.	31. 5.217.
8. 1.7.	14. 7.9.	20. 5.17.	26. 6.75.	32. 1.125.
9. 3.7.	15. 9.2.	21. 5.71.	27. 0.15.	33. 1.250.
10. 4.8.	16. 9.7.	22. 1.75.	28. 2.15.	34. 2.375.

35. What is the name of the first decimal place? of the second? of the third?

Write the following numbers as decimals:

36. Three hundredths.
37. Seven hundredths.
38. One and three tenths.
39. Two and seven tenths.
40. Twenty-six hundredths.
41. 9 tenths.
42. 9 hundredths.
43. 19 hundredths.
44. 19 thousandths.
45. 195 thousandths.

A SILENT READING LESSON

With a steel tape which was marked in feet and tenths of a foot, a class measured the sides of a large triangular flower bed in a park. The sides were found to be 48.7 ft., 53.8 ft., and 62.9 ft.

Writing the numbers in a column, and adding as with United States money, the class found that it was 165.4 ft. around the bed.

$$\begin{array}{r} 48.7 \\ 53.8 \\ \underline{62.9} \\ 165.4 \end{array}$$

No measurement of length, area, volume, or weight is ever exact.

With instruments such as ordinary rulers and tapes the error may be small, and with finer instruments still smaller; but the measurement is never exact.

In the above case the class measured to the nearest tenth of a foot (0.1 ft.). With such a tape we cannot measure to the nearest 0.01 ft.; that is, any measurement made with it is a measurement *to the nearest 0.1 ft. only.*

The class found an old automobile highway that was being extended a distance of 4.10 mi. After 0.26 mi. is completed, how much is still to be built?

Since one distance, 0.26 mi., is given to the nearest 0.01 mi., the other, 4.10 mi., is given in the same way, and not as 4.1 mi. If one measurement can be found to hundredths, the other can also be so found.

$$\begin{array}{r} 4.10 \\ \underline{.26} \\ 3.84 \end{array}$$

Subtracting, as with United States money, the class finds that there are still 3.84 mi. to be built.

No result can be more nearly exact than the measurements from which it is found.

DRILL CHART IN DECIMALS

Add as follows:

1.	2.	3.	4.	5.
$7.46	$3.28	58.98	18.29	72.74
8.62	6.42	26.88	.09	31.08
3.88	8.00	6.09	13.50	7.89

Subtract as follows:

6.	7.	8.	9.	10.
80.22	60.28	69.60	75.32	47.04
20.08	31.99	22.98	38.96	8.60

Add as follows:

11.	12.	13.	14.	15.
62.86	72.36	3.627	612.4	8.289
2.98	3.98	3.684	328.2	.498
51.82	85.63	2.928	287.7	.489
33.59	39.36	4.004	428.6	4.060
41.23	42.05	2.800	371.8	7.000
4.89	20.68	3.304	366.6	.076

Subtract as follows:

16.	17.	18.	19.	20.
17.00	27.00	27.00	270.0	5.175
6.12	8.12	18.12	182.7	2.299

Add the following:

21. 18.27 ft., 32.65 ft.

22. 11.32 ft., 26.99 ft.

23. 28.4 mi., 46.7 mi.

24. 16.92 mi., 28.37 mi.

25. 8.7 ft., 6.9 ft., 7.2 ft.

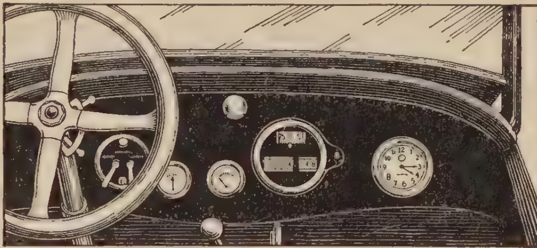
26. 5.8 in., 7.2 in., 9.0 in.

27. 7.9 in., 8.3 in., 8.4 in.

28. 8.1 mi., 6.9 mi., 8.7 mi.

ADDING AND SUBTRACTING DECIMALS

1. The mileage dial of a speedometer registered 2148.8 mi. in the morning and 2307.4 mi. at night on the sameday. How many miles did this show that the car went that day?



2. The mileage dial of a speedometer registered 1872.9 mi. at the beginning of a trip of 298.8 mi. How much did it register at the end of the trip?

3. On a four-day automobile trip the distances traveled were 127.8 mi., 146.3 mi., 162.9 mi., and 96.4 mi. What was the total distance traveled?

4. When Henry started out one morning, the cyclometer on his bicycle registered 127.6 mi. When he returned, it registered 141.3 mi. How far did he go?

5. The normal temperature of the body is 98.6 degrees. When Clara had the measles, her temperature rose to 102.1 degrees. How much was this above normal?

6. An airplane made 126.3 mi. the first hour of a trip, 112.8 mi. the second, and 94.9 mi. the third. Find the total distance covered.

7. The weather bureau reported the rainfall in New York City for seven successive days to be 1.35 in., 1.80 in., 1.25 in., 0 in., 0.08 in., 0 in., 1.07 in. Find the total rainfall.

SPEED TEST CHART IN ADDING DECIMALS

Copy and add the following in 1 min.:

1. 2.9	2. 13.4	3. 14.69	4. 28.30	5. 7.734
4.6	5.9	7.06	33.98	2.976

Copy and add the following in 4 min.:

6. 4.5	8. 17.3	10. 33.48	12. 36.83	14. 8.824
3.6	14.6	7.80	3.08	2.499
6.9	7.6	18.09	.79	.696
7. 6.9	9. 42.8	11. 13.68	13. 74.86	15. 9.008
7.8	14.9	9.56	.86	7.860
2.5	8.0	4.46	38.00	.009
3.2	7.6	1.27	8.02	.016

Copy and add the following in 8 min.:

16. 68.74	18. 49.06	20. 63.78	22. 39.86	24. 6.768
4.36	8.68	36.86	4.23	5.390
21.09	44.00	8.08	29.68	6.009
37.62	6.70	43.50	42.00	.620
.63	10.07	3.32	.62	4.371
17. 33.49	19. 42.48	21. 61.69	23. 72.98	25. 7.956
62.68	.90	47.98	4.48	3.754
81.89	35.00	52.79	67.00	9.683
.73	3.98	4.28	6.93	8.426
43.06	42.09	47.60	33.98	9.900

Changing a Decimal to a Fraction. At a bargain sale Edward finds that he can buy a radio set for 0.25 less than the regular price. At another store he is told that he can buy a similar set for $\frac{1}{5}$ less than the same regular price. Can you tell which is the larger reduction?

You know that 0.25 means $\frac{25}{100}$, which is equal to $\frac{1}{4}$, and so the first reduction is the larger. That is,

To change a decimal to a fraction, write the decimal as a fraction with the denominator that is indicated by the number of decimal places and reduce to lowest terms.

In a case like that of $0.33\frac{1}{3}$ we proceed as follows:

$$0.33\frac{1}{3} = \frac{33\frac{1}{3}}{100} = \frac{\frac{100}{3}}{100} = \frac{100}{300} = \frac{1}{3}.$$

A number like 3.75, which consists of a whole number and a decimal, is sometimes called a *mixed decimal.*

CHANGING DECIMALS TO FRACTIONS

1. Which is the better for the buyer, a reduction of $\frac{1}{5}$ from the regular price or one of 0.15? Why is it better?

Change to fractions or to mixed numbers:

2. 0.6. 3. 0.30. 4. 0.825. 5. 8.25. 6. 0.625.

7. Express 0.125 as eighths. Find 0.125 of $3200.

8. Express $0.33\frac{1}{3}$ as thirds. Find $0.33\frac{1}{3}$ of $7110.75.

Express the following decimals as thirds:

9. $0.6\frac{2}{3}$. 11. $1.3\frac{1}{3}$. 13. $1.6\frac{2}{3}$. 15. $2.66\frac{2}{3}$. 17. $3.3\frac{1}{3}$.

10. $0.66\frac{2}{3}$. 12. $1.33\frac{1}{3}$. 14. $1.66\frac{2}{3}$. 16. $6.66\frac{2}{3}$. 18. $7.33\frac{1}{3}$.

Annexing Zeros to a Decimal. Edward said that he paid twenty-four and a half dollars for his radio set. If he wrote \$24.5 on the board, did he write the amount in the customary business way? How should it be written?

While \$24.5 means \$24½, neither of these is the correct business form, since we usually write \$24.50.

Is there any difference in value between \$1.5 and \$1.50? between \$3.2 and \$3.20? We thus see that

Annexing zeros to a decimal does not change the value.

Decimals which have the same number of decimal places are sometimes called *similar decimals.*

To write decimals as similar decimals, annex or cut off zeros at the right until they have the same number of decimal places.

For example, we may write 0.3, 0.25, and 2.125 as 0.300, 0.250, and 2.125.

ANNEXING ZEROS TO DECIMALS

1. In subtracting 1.75 from 2.6, it is easier to write the numbers as similar decimals. Write them in this way.

Express the following as similar decimals:

2. 0.5, 0.35.
3. 0.2, 0.02.
4. 0.5, 0.008.
5. 0.8, 0.648.
6. 0.8, 0.900.
7. 0.7, 0.080.
8. 0.12, 0.508.
9. 0.35, 0.008.
10. 0.89, 0.060.

11. Write in the easiest form for subtraction, and then subtract 18.25 from 34.3; 29.004 from 35.06; 13.006 from 17.23.

Changing a Fraction to a Decimal. The average height of the girls in a certain class was found to be $55\frac{4}{5}$ in. In reporting this fact the teacher used a decimal. How is $\frac{4}{5}$ written as a decimal?

Since $\frac{4}{5}$ means the same as $4 \div 5$, or $4.0 \div 5$, we simply divide 4.0, placing the decimal point as we do in dividing United States money.

$$\boxed{\begin{array}{r} 0.8 \\ 5\overline{)4.0} \end{array}}$$

To change a fraction to a decimal, place a decimal point after the numerator and divide by the denominator.

A fraction cannot always be changed to an exact decimal. A fraction or a series of dots is sometimes used to indicate this fact; for example, we may write, $\frac{1}{3} = 0.33\frac{1}{3}$, or $\frac{1}{3} = 0.333 \cdots$. More often we write simply 0.33 or 0.333, discarding the fraction.

In the case of $\frac{2}{3}$ we have $\frac{2}{3} = 0.6\frac{2}{3} = 0.66\frac{2}{3} = 0.666\frac{2}{3}$. We usually write 0.67 for $0.66\frac{2}{3}$ or 0.667 for $0.666\frac{2}{3}$; that is, we discard the fraction if it is less than $\frac{1}{2}$, and increase the last figure by 1 if the fraction is $\frac{1}{2}$ or greater.

In some cases we write 0.333 + and 0.667 −, indicating that in one case the exact value is more than 0.333 and in the other less than 0.667.

CHANGING FRACTIONS TO DECIMALS

1. John reads in a book that lead is $11\frac{7}{20}$ times as heavy as water. Write $11\frac{7}{20}$ with a decimal.

Change to decimals having not more than three places:

2. $\frac{3}{4}$.	**4.** $\frac{4}{5}$.	**6.** $\frac{1}{16}$.	**8.** $\frac{13}{16}$.	**10.** $\frac{5}{32}$.	**12.** $\frac{5}{6}$.
3. $\frac{5}{8}$.	**5.** $\frac{7}{8}$.	**7.** $\frac{3}{16}$.	**9.** $\frac{1}{32}$.	**11.** $\frac{9}{25}$.	**13.** $\frac{8}{9}$.

A SILENT READING LESSON

In a book about France, Mary read of a tower that was 35 meters high, and she wanted to know how many feet this was. Her father told her that a meter was equivalent to 3.28 ft. Mary saw that she would have to multiply 3.28 ft. by 35.

She multiplied just as she would have multiplied \$3.28 by 35, and found that the height of the tower was 114.80 ft.

$$\begin{array}{r} 3.28 \\ 35 \\ \hline 1640 \\ 984 \\ \hline 114.80 \end{array}$$

If we are multiplying $\frac{7}{1000}$ by 5, we see that we have

$$5 \times \frac{7}{1000} = \frac{35}{1000},$$

and so

$$5 \times 0.007 = 0.035.$$

That is, we can tell where to put the decimal point by comparing the decimal with the common fraction.

John read in a machinery handbook that the number of inches around a pulley, which is 7 in. across, is 7×3.142.

John multiplied as with whole numbers. He saw that if he multiplied 0.002 by 7, the result would be thousandths. He thus saw that there were three decimal places in the result, and that the distance was 21.994 in., or nearly 22 in.

$$\begin{array}{r} 3.142 \\ 7 \\ \hline 21.994 \end{array}$$

In multiplying decimals, there are as many decimal places in the product (result) as there are in the two numbers together.

That is, in multiplying 3.28 by 35 Mary had 2 + 0, or 2 decimal places, and in multiplying 3.142 by 7 John had 3 + 0, or 3 decimal places.

DRILL CHART IN MULTIPLYING DECIMALS

Multiply as follows:

1. 5×8.06 ft.	**13.** 19×4.77.	**25.** 28×20.09.
2. 7×5.38 in.	**14.** 36×5.32.	**26.** 94×66.82.
3. 4×5.32 mi.	**15.** 15×4.28.	**27.** 73×81.62.
4. 6×3.08 in.	**16.** 42×7.22.	**28.** 55×70.03.
5. 9×8.75 ft.	**17.** 94×3.28.	**29.** 15×44.34.
6. 7×0.96 oz.	**18.** 81×4.48.	**30.** 19×19.96.
7. 8×0.73 ft.	**19.** 85×8.23.	**31.** 50×27.85.
8. 5×3.77 yd.	**20.** 92×3.32.	**32.** 36×49.82.
9. 7×8.08 ft.	**21.** 34×5.81.	**33.** 40×17.77.
10. 2×4.26 in.	**22.** 78×8.22.	**34.** 32×28.65.
11. 3×5.08 ft.	**23.** 66×4.92.	**35.** 80×39.37.
12. 7×6.35 lb.	**24.** 62×2.48.	**36.** 92×64.28.

In multiplying 2.8 by $3\frac{1}{2}$, multiply as if you had $3\frac{1}{2} \times 28$, and point off $0 + 1$ decimal places. Multiply in the same way in each of these cases:

37. $2\frac{1}{2} \times 12.4$.	**45.** $3\frac{1}{2} \times 68.38$.	**53.** $5\frac{2}{3} \times 8.763$.
38. $6\frac{3}{4} \times 12.8$.	**46.** $3\frac{1}{2} \times 46.64$.	**54.** $7\frac{1}{3} \times 9.645$.
39. $7\frac{1}{2} \times 22.8$.	**47.** $2\frac{1}{2} \times 41.14$.	**55.** $4\frac{5}{8} \times 7.096$.
40. $9\frac{1}{8} \times 64.8$.	**48.** $6\frac{1}{2} \times 51.10$.	**56.** $3\frac{7}{8} \times 3.496$.
41. $8\frac{2}{5} \times 24.5$.	**49.** $2\frac{1}{4} \times 88.60$.	**57.** $5\frac{3}{8} \times 2.736$.
42. $6\frac{1}{3} \times 18.6$.	**50.** $4\frac{3}{4} \times 70.08$.	**58.** $8\frac{1}{6} \times 1.728$.
43. $9\frac{2}{3} \times 12.9$.	**51.** $2\frac{3}{4} \times 86.04$.	**59.** $3\frac{5}{6} \times 3.456$.
44. $8\frac{7}{8} \times 25.6$.	**52.** $7\frac{1}{4} \times 92.36$.	**60.** $3\frac{1}{8} \times 6.912$.

A SILENT READING LESSON

Edward's father is building a silo to hold feed for his cattle. The silo is 15 ft. $3\frac{1}{2}$ in. in diameter. He asks Edward to find the length of an iron band that will just go round the silo, telling him that he can do this by taking 15 ft. $3\frac{1}{2}$ in. as practically equal to 15.3 ft. and then multiplying 15.3 ft. by 3.1.

Multiplying 15.3 by 3.1 in the ordinary way, Edward first finds that the result is 4743.

Thinking of common fractions, Edward then sees that

$$\tfrac{1}{10} \times \tfrac{3}{10} = \tfrac{3}{100},$$

and in this way he sees that

$$0.1 \times 0.3 = 0.03.$$

$$\begin{array}{r} 15.3 \text{ ft.} \\ \underline{3.1} \\ 153 \\ \underline{459} \\ 47.43 \text{ ft.} \end{array}$$

Edward therefore places the decimal point after the 7 in the result; that is, he points off two decimal places from the right, and thus finds that the length of the band, to the nearest 0.1 ft., must be 47.4 ft., or about 47 ft. 5 in.

In multiplying by a decimal, multiply as with whole numbers, and then, beginning at the right, point off as many decimal places in the product as there are decimal places in the two numbers together.

Thus, in the case above, Edward had 1 + 1 decimal places and so pointed off two places in the result.

USING DECIMALS

1. Taking the rod as 16.5 ft., how many feet are there in 19 rd.? in 27 rd.? in 33.6 rd.?

2. In city surveying, decimal parts of a foot are generally used, and a "front foot" means 1 ft. along the street on which the land fronts. At $36.50 per front foot, find the cost of a piece of land with a frontage of 33.3 ft.

3. If we multiply 1.7 by $12.76, the result is $216.92, $2.1692, $21.693, or $21.692. Without actually multiplying, state which it is.

4. The circumference of (the distance around) a circle is 3.1416 times the diameter. If the diameter is 13.4 ft., what is the circumference? Since the diameter is given to the nearest 0.1 ft., give the result in the same way.

5. A cubic foot of water weighs 62.5 lb., and ice is 0.92 times as heavy as water. How much does 1 cu. ft. of ice weigh? Why should you give the result only to the nearest 0.1 lb.?

6. Oak is 1.17 times as heavy as water (see Ex. 5). How much does 1 cu. ft. of oak weigh?

Find the value in each of the following cases:

7. $3.14 + 1.89$.	**13.** $0.318 + 0.125$.	**19.** $4.19 + 3.09$.
8. $3.14 - 1.89$.	**14.** $0.318 - 0.125$.	**20.** $4.19 - 3.09$.
9. 3.14×1.89.	**15.** 0.318×0.125.	**21.** 4.19×3.09.
10. 3.14×18.9.	**16.** 0.318×1.25.	**22.** 4.19×30.9.
11. 3.14×0.189.	**17.** 0.318×12.5.	**23.** 4.19×0.309.
12. 3.14×1890.	**18.** 0.318×1250.	**24.** 4.19×3090.

DRILL CHART IN MULTIPLYING DECIMALS

Numbers 1 to 24, oral

Multiply as follows:

1. $0.6 \times 3.$	9. $0.3 \times 0.5.$	17. $0.8 \times 0.12.$
2. $0.3 \times 6.$	10. $0.6 \times 0.8.$	18. $0.3 \times 0.15.$
3. $0.1 \times 5.$	11. $0.9 \times 0.7.$	19. $0.7 \times 0.11.$
4. $0.3 \times 4.$	12. $0.7 \times 0.9.$	20. $0.10 \times 0.12.$
5. $0.6 \times 7.$	13. $0.2 \times 0.3.$	21. $0.10 \times 0.34.$
6. $0.7 \times 3.$	14. $0.4 \times 0.4.$	22. $0.11 \times 0.11.$
7. $0.3 \times 7.$	15. $0.7 \times 0.8.$	23. $0.12 \times 0.12.$
8. $0.1 \times 2.$	16. $0.8 \times 0.8.$	24. $0.06 \times 0.24.$

Multiply, recording your time for each column:

25. $4 \times 0.49.$	36. $6 \times 9.23.$	47. $0.6 \times 74.$
26. $0.32 \times 7.$	37. $0.9 \times 74.$	48. $0.8 \times 4.9.$
27. $3 \times 2.75.$	38. $0.6 \times 7.2.$	49. $1.4 \times 35.$
28. $3 \times 0.97.$	39. $7.7 \times 85.$	50. $1.4 \times 2.6.$
29. $0.87 \times 8.$	40. $3.1 \times 8.1.$	51. $0.5 \times 48.$
30. $7 \times 2.42.$	41. $58 \times 0.8.$	52. $0.5 \times 4.8.$
31. $3 \times 0.78.$	42. $6.7 \times 7.8.$	53. $6.3 \times 4.86.$
32. $0.83 \times 6.$	43. $0.6 \times 96.$	54. $96 \times 9.65.$
33. $8 \times 7.23.$	44. $0.7 \times 7.8.$	55. $5.4 \times 3.53.$
34. $9 \times 0.93.$	45. $1.8 \times 67.$	56. $73.2 \times 98.6.$
35. $0.27 \times 9.$	46. $2.9 \times 3.4.$	57. $0.42 \times 390.$

Multiplying by 10, 100, and 1000. We multiply a whole number by 10 by simply annexing a zero, as follows:

$$10 \times 35 = 350 \qquad 10 \times 2750 = 27{,}500$$

In multiplying by 100 we annex two zeros, and in multiplying by 1000 we annex three zeros, as follows:

$$100 \times 125 = 12{,}500 \qquad 1000 \times 350 = 350{,}000$$

Multiplying decimals by 10, 100, and 1000 is similar to multiplying dollars and cents; that is, we move the decimal point to the right one place for 10, two places for 100, three places for 1000, and so on, as in the following cases:

$$100 \times 32.5 = 3250 \qquad 1000 \times 2.752 = 2752$$

$$1000 \times \$12.75 = \$12{,}750 \qquad 1000 \times 37.25 = 37{,}250$$

MULTIPLYING BY 10, 100, AND 1000

Multiply the following numbers by 10:

1. 35.	**3.** 3.5.	**5.** 0.35.	**7.** 23.7.	**9.** 625.
2. 42.	**4.** 4.2.	**6.** 1.42.	**8.** 2.37.	**10.** 62.5.

Multiply the following by 100:

11. 125.	**14.** 6.125.	**17.** 3.75.	**20.** 150.	**23.** 2725.
12. 12.5.	**15.** 61.25.	**18.** 37.5.	**21.** 15.0.	**24.** 27.25.
13. 1.25.	**16.** 612.5.	**19.** 375.	**22.** 1.50.	**25.** 0.2725.

Multiply the following by 1000:

26. 275.	**29.** 0.275.	**32.** 727.5.	**35.** 0.02.	**38.** 0.0001.
27. 27.5.	**30.** 627.5.	**33.** 8275.	**36.** 0.12.	**39.** 0.0011.
28. 2.75.	**31.** 62.75.	**34.** 92.25.	**37.** 0.125.	**40.** 0.0111.

Multiplying by Multiples of 10. We have just found how to multiply by 10, 100, 1000, and so on for other powers of 10. We also know how to multiply by whole numbers like 40, 700, and so on. Multiplying decimals by such numbers is similar to multiplying dollars and cents.

That is, in multiplying 487.7 by 600, move the decimal point two places to the right and multiply by 6.

In multiplying 89.07 by 740, move the decimal point one place to the right and multiply by 74.

MULTIPLYING BY MULTIPLES OF 10

Numbers 1 to 16, oral

State the value in each of the following cases:

1. $5 \times \frac{1}{5}$.	**6.** 10×6.	**11.** 100×0.02.
2. $4 \times \frac{1}{4}$.	**7.** 10×0.6.	**12.** 100×0.65.
3. $7 \times \frac{1}{7}$.	**8.** 20×0.6.	**13.** $1000 \times \frac{1}{1000}$.
4. $10 \times \frac{1}{10}$.	**9.** $100 \times \frac{1}{100}$.	**14.** 1000×0.001.
5. 10×0.1.	**10.** 100×0.01.	**15.** 1000×0.125.

16. How do you multiply a decimal by 40? by 600? by 1000? by 2000? by 70? by 700? by 7000?

Multiply as follows:

17. 50×8.74.	**23.** 60×725.8.	**29.** 7250×67.28.
18. 40×6.89.	**24.** 700×67.09.	**30.** 6220×750.4.
19. 70×7.81.	**25.** 500×61.6.	**31.** 5600×895.7.
20. 30×86.4.	**26.** 1000×2.25.	**32.** 3500×774.66.
21. 40×36.6.	**27.** 4970×83.2.	**33.** 4500×508.07.
22. 80×45.49.	**28.** 2000×3.725.	**34.** $25{,}000 \times 1.25$.

Short Division by a Whole Number. Suppose that you buy two melons at the same price, paying 30¢, or \$0.30, for the two. How much do they cost apiece?

First place the decimal point just above the decimal point in the number divided.

Then divide as with whole numbers.

The result is 0.15; that is, the cost is 15¢.

Check. $2 \times 0.15 = 0.30.$

$$\begin{array}{r} . \\ 2\overline{)0.30} \end{array} \qquad \begin{array}{r} 0.15 \\ 2\overline{)0.30} \end{array}$$

Similarly, in dividing 27.125 by 5, we have

$$5\overline{)27.125} \quad \text{and} \quad \begin{array}{r} 5.425 \\ 5\overline{)27.125} \end{array}$$

SHORT DIVISION BY A WHOLE NUMBER

Divide as indicated:

1. $2\overline{)2.48}$	**11.** $2\overline{)0.136}$	**21.** $7\overline{)1540}$	**31.** $8\overline{)656}$
2. $3\overline{)2.49}$	**12.** $2\overline{)1.360}$	**22.** $7\overline{)1.540}$	**32.** $8\overline{)65.6}$
3. $4\overline{)2.48}$	**13.** $3\overline{)13.6}$	**23.** $7\overline{)15.40}$	**33.** $8\overline{)65.68}$
4. $5\overline{)2.65}$	**14.** $4\overline{)13.6}$	**24.** $7\overline{)154.7}$	**34.** $8\overline{)6.568}$
5. $6\overline{)2.52}$	**15.** $5\overline{)1.360}$	**25.** $7\overline{)1561}$	**35.** $8\overline{)0.6568}$
6. $7\overline{)2.45}$	**16.** $5\overline{)1.36}$	**26.** $7\overline{)156.1}$	**36.** $8\overline{)2.5826}$
7. $8\overline{)2.56}$	**17.** $6\overline{)13.8}$	**27.** $7\overline{)15.61}$	**37.** $8\overline{)22.568}$
8. $9\overline{)25.2}$	**18.** $6\overline{)1.38}$	**28.** $7\overline{)1.561}$	**38.** $8\overline{)225.68}$
9. $2\overline{)32.4}$	**19.** $6\overline{)0.138}$	**29.** $7\overline{)0.1561}$	**39.** $8\overline{)2256.8}$
10. $3\overline{)0.87}$	**20.** $6\overline{)0.0138}$	**30.** $7\overline{)1.5561}$	**40.** $9\overline{)22.563}$

Dividing by a Whole Number. On an automobile trip Walter and his father went 925.9 mi. in 13 da. Find to the nearest 0.1 mi. the average distance which they went per day.

$$\begin{array}{r} 71.2 \\ 13\overline{)925.9} \\ \underline{91} \\ 15 \\ \underline{13} \\ 2\,9 \\ \underline{2\,6} \\ 3 \end{array}$$

Dividing as with United States money, we find that the average daily distance was a little over 71.2 mi.

If we wish to show that the result is greater than 71.2 but less than 71.25, we may write 71.2 +. If the result is 71.25 or greater, but less than 71.3, we may write 71.3 −. More often we write simply 71.2 or 71.3, omitting the signs.

To find the nearest tenth, find the second decimal figure and change the first decimal figure if necessary.

DIVIDING BY A WHOLE NUMBER

In each of the following cases state the number of decimal places to which the result should be given, and then divide:

1. $2\overline{)3.4\text{ in.}}$
2. $6\overline{)4.72\text{ mi.}}$
3. $9\overline{)0.127\text{ in.}}$
4. $3\overline{)81.6\text{ in.}}$
5. $4\overline{)81.6\text{ in.}}$
6. $5\overline{)81.6\text{ in.}}$
7. $6\overline{)81.6\text{ in.}}$
8. $15\overline{)12.68\text{ mi.}}$
9. $14\overline{)1.278\text{ in.}}$
10. $32\overline{)12.3142\text{ in.}}$
11. $25\overline{)62.75\text{ in.}}$
12. $25\overline{)627.5\text{ in.}}$
13. $25\overline{)6.275\text{ in.}}$
14. $28\overline{)596.4\text{ in.}}$
15. $7\overline{)2.75\text{ ft.}}$
16. $18\overline{)6.70\text{ in.}}$
17. $23\overline{)0.592\text{ mi.}}$
18. $23\overline{)59.20\text{ mi.}}$
19. $23\overline{)5.920\text{ mi.}}$
20. $23\overline{)592.0\text{ mi.}}$
21. $36\overline{)0.144\text{ in.}}$

22. The distance around a triangle which has its sides all equal is 23.1 in. What is the length of each side?

23. The distance around a six-sided figure with equal sides is 15.24 in. What is the length of each side?

24. Four boys who are going camping pay $21.48 for their outfit. How much is each boy's share?

25. The distance between two places is known to be 12.5 mi. What is one third of the distance between them?

26. The distance from second base straight to home plate is 127.3 ft. Find the distance from home plate to a point one fourth of the way to second base.

Divide, giving each result to the nearest tenth:

27. $6\overline{)6277.8}$	30. $68\overline{)702.7}$	33. $72\overline{)44.2}$
28. $8\overline{)2748.1}$	31. $22\overline{)434.8}$	34. $29\overline{)36.7}$
29. $33\overline{)262.9}$	32. $37\overline{)517.6}$	35. $12\overline{)89.8}$

Divide, giving each result to the nearest hundredth:

36. $52.83 \div 31$.	43. $63.42 \div 67$.	50. $39.09 \div 32$.
37. $42.06 \div 44$.	44. $22.37 \div 43$.	51. $37.02 \div 42$.
38. $39.34 \div 73$.	45. $44.86 \div 38$.	52. $53.09 \div 72$.
39. $72.09 \div 28$.	46. $42.73 \div 16$.	53. $60.27 \div 28$.
40. $67.34 \div 33$.	47. $68.42 \div 37$.	54. $50.09 \div 762$.
41. $40.73 \div 46$.	48. $72.26 \div 35$.	55. $81.24 \div 306$.
42. $50.06 \div 57$.	49. $80.71 \div 53$.	56. $93.03 \div 600$.

Divide, giving each result to the nearest thousandth:

57. $21.143 \div 23$.	58. $63.856 \div 47$.	59. $9.030 \div 237$.

Dividing by Powers of 10. Just as in multiplying by powers of 10 we move the decimal point to the right, so in dividing we move it to the left.

To divide by 10, move the decimal point one place to the left.

Thus, $7.2 \div 10 = 0.72$, and $69.872 \div 10 = 6.9872$.

To divide by 100, move the decimal point two places to the left, and to divide by 1000, move it three places to the left.

Thus, $8.7 \div 100 = 0.087$, and $123.62 \div 1000 = 0.12362$.

Dividing by Multiples of Powers of 10. *To divide by a number ending in zeros, move the decimal point in the number divided as many places to the left as there are zeros in the divisor (the number by which you divide). Then divide by the number preceding the zeros.*

That is, in dividing 216 by 600, proceed as if you were to divide 2.16 by 6. Then, as here shown, $216 \div 600 = 0.36$.

$$\begin{array}{r} 0.36 \\ 6\cancel{0}\cancel{0}\overline{)2.16} \end{array}$$

DIVIDING BY TENS

Divide each of the following by 10 and also by 100:

1. 375. **2.** 37. **3.** 3. **4.** 0.2. **5.** 3.7. **6.** 13.5.

Divide each of the following by 1000:

7. 300. **8.** 30. **9.** 3. **10.** 25. **11.** 250. **12.** 275.

Divide as follows:

13. $70\overline{)39.9}$ **16.** $470\overline{)296.1}$ **19.** $21{,}000\overline{)882}$

14. $60\overline{)70.8}$ **17.** $4000\overline{)2984}$ **20.** $37{,}000\overline{)888}$

15. $290\overline{)5191}$ **18.** $3000\overline{)8436}$ **21.** $1250\overline{)63.75}$

Dividing a Whole Number by a Decimal. Before learning how to divide by a decimal it is necessary to notice that we get the same results in each of these four divisions:

$$\begin{array}{r}3\\2\overline{)6}\end{array}\qquad\begin{array}{r}3\\20\overline{)60}\end{array}\qquad\begin{array}{r}3\\200\overline{)600}\end{array}\qquad\begin{array}{r}3\\2000\overline{)6000}\end{array}$$

Multiplying both the number divided and the divisor by the same number does not change the result.

Thus, if we wish to divide 1.255 by 0.05, we move the decimal point two places to the right in each case so that we can divide by a whole number, and have

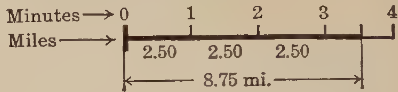
$$0.05\overline{)1.255}\qquad 5\overline{)125.5}\qquad\begin{array}{r}25.1\\5\overline{)125.5}\end{array}$$

DIVIDING A WHOLE NUMBER BY A DECIMAL

Divide as follows:

1. $2\overline{)4}$	**11.** $3\overline{)6}$	**21.** $5\overline{)10}$
2. $0.2\overline{)4}$	**12.** $0.3\overline{)6}$	**22.** $5\overline{)1.0}$
3. $0.02\overline{)4}$	**13.** $3\overline{)60}$	**23.** $5\overline{)1}$
4. $2\overline{)400}$	**14.** $0.3\overline{)60}$	**24.** $0.5\overline{)1}$
5. $0.2\overline{)400}$	**15.** $0.03\overline{)6}$	**25.** $0.5\overline{)100}$
6. $2\overline{)7}$	**16.** $0.03\overline{)60}$	**26.** $0.05\overline{)10}$
7. $0.2\overline{)7}$	**17.** $0.003\overline{)6}$	**27.** $0.05\overline{)1}$
8. $0.02\overline{)7}$	**18.** $0.004\overline{)6}$	**28.** $0.005\overline{)1}$
9. $2\overline{)70}$	**19.** $0.005\overline{)6}$	**29.** $0.005\overline{)10}$
10. $0.2\overline{)70}$	**20.** $0.05\overline{)600}$	**30.** $0.005\overline{)100}$

Getting Ready to Divide by a Decimal. If an airplane can fly 2.50 mi. a minute, how long will it take the plane to go 8.75 mi.?



As shown by this line, it will take as many minutes as the distance covered in 1 min. is contained in 8.75 mi. That is, we must find the result of dividing 8.75 by 2.50.

We move the decimal point as many places to the right in both the divisor and the number divided as is necessary to make the divisor a whole number, placing the decimal point for the result in the proper place. This should be done when writing the example.

$$\begin{array}{r} 3.5 \\ 25\overline{)87.5} \\ \underline{75} \\ 125 \\ \underline{125} \end{array}$$

In dividing by a decimal, move the decimal points as many places to the right as is necessary to make the divisor a whole number, place the decimal point for the result above the point in the number divided, and divide as with whole numbers.

DIVIDING BY A DECIMAL

State how many places you will move the decimal points to the right in each of these divisions:

1. $0.6\overline{)30}$
2. $0.6\overline{)3.0}$
3. $0.6\overline{)0.3}$
4. $0.6\overline{)0.03}$
5. $0.06\overline{)0.03}$
6. $1.2\overline{)1.44}$
7. $0.12\overline{)1.44}$
8. $0.12\overline{)14.4}$
9. $1.2\overline{)14.4}$
10. $0.12\overline{)0.144}$
11. $1.25\overline{)1.375}$
12. $12.5\overline{)13.75}$
13. $1.25\overline{)137.5}$
14. $0.125\overline{)13.75}$
15. $0.125\overline{)0.1375}$

DIVISION WITH DECIMALS

1. How long will it take a train traveling 0.8 mi. a minute to go 25.7 mi.? to go 32.8 mi.? How far does common sense tell you to carry the result?

2. How long will it take a train traveling 0.9 mi. a minute to go 36.9 mi.? to go 47 mi.?

3. How long will it take an airplane traveling at the rate of 1.2 mi. a minute to go 20.4 mi.?

4. The speedometer of an automobile shows that the car has gone 37.4 mi. on a trip of 187 mi. What part of the total distance has the car gone?

5. A workman finds that a pile of 500 metal plates is 10.00 in. high. The measurement 10.00 in. indicates that he measured the pile to the nearest 0.01 in. What is the average thickness of each plate?

Divide as follows, first estimating each result:

6. $67.25 \div 500$.	**8.** $887.6 \div 700$.	**10.** $54.54 \div 9000$.
7. $5.248 \div 200$.	**9.** $96.48 \div 8000$.	**11.** $0.9366 \div 7000$.

Divide as follows, first estimating each result and then finding it to the nearest thousandth:

12. $17.78 \div 1.5$.	**15.** $19.26 \div 3.1$.	**18.** $33.43 \div 6.8$.
13. $62.23 \div 0.23$.	**16.** $21.43 \div 3.7$.	**19.** $423.6 \div 0.27$.
14. $5.423 \div 0.38$.	**17.** $584.3 \div 5.9$.	**20.** $8.297 \div 7.9$.

21. Traveling at the rate of 42.7 mi. an hour, how long will it take a train to go 128.1 mi.?

22. Divide 0.7 by 0.91 to the nearest ten-thousandth.

ORAL REVIEW DRILL CHART IN DECIMALS

Perform the following additions:

1. 2.1	**2.** 4.3	**3.** 3.1	**4.** 4.2	**5.** 4.2
3.2	5.6	7.9	.8	1.9

Perform the following subtractions:

6. 3.4	**7.** 3.4	**8.** 3.4	**9.** 6.0	**10.** 7.3
1.3	1.4	.5	2.7	.5

Perform the following multiplications:

11. 12	**13.** 1.2	**15.** 20	**17.** 2.0	**19.** 2
2	2	3	3	0.3
12. 12	**14.** 1.2	**16.** 20	**18.** 2.0	**20.** 0.2
0.2	0.2	0.3	0.3	0.3

Perform the following divisions:

21. 12 ÷ 3.
22. 1.2 ÷ 3.
23. 1.2 ÷ 0.3.
24. 12 ÷ 0.3.
25. 25 ÷ 5.
26. 2.5 ÷ 5.
27. 2.5 ÷ 0.5.
28. 25 ÷ 0.5.
29. 20 ÷ 10.
30. 2.0 ÷ 10.
31. 2.0 ÷ 1.0.
32. 2 ÷ 1.0.
33. 24 ÷ 12.
34. 2.4 ÷ 12.
35. 2.4 ÷ 1.2.
36. 0.24 ÷ 1.2.
37. 4.8 ÷ 2.4.
38. 4.8 ÷ 24.
39. 48 ÷ 0.24.
40. 0.48 ÷ 0.24.
41. 2.25 ÷ 0.15.
42. 22.5 ÷ 1.5.
43. 0.225 ÷ 1.5.
44. 22.5 ÷ 0.15.

Decimals and Fractions Combined. If we buy 2 collars for 25¢, the price per collar is half of 25¢, or $12\frac{1}{2}$¢. We may write $12\frac{1}{2}$¢ as \$0.12$\frac{1}{2}$.

If we divide 0.25 by 2, we have either

$$2\overline{)0.25}\text{ giving }0.12\tfrac{1}{2} \qquad \text{or} \qquad 2\overline{)0.250}\text{ giving }0.125$$

That is,

$$0.12\tfrac{1}{2} = 0.125,$$
$$1.2\tfrac{1}{2} = 1.25,$$

and so on for other numbers like $37.4\frac{1}{2}$ and $4.26\frac{1}{2}$.

We also know that $\frac{1}{4} = 1 \div 4 = 0.25$, and so

$$1.2\tfrac{1}{4} = 1.225 \qquad 3\tfrac{3}{4} = 3.75$$
$$42\tfrac{1}{4} = 42.25 \qquad 0.3\tfrac{3}{4} = 0.375$$

and so on. That is, we may combine decimals and fractions. Such a number may be reduced to the form of a decimal, at least approximately, or to that of a fraction.

DECIMALS AND FRACTIONS COMBINED

Write the following in the decimal form:

1. $2\frac{1}{2}$.	**4.** $32\frac{1}{2}$.	**7.** $1.3\frac{1}{2}$.	**10.** $\frac{1}{2}$.	**13.** $2.75\frac{1}{2}$.
2. $0.2\frac{1}{2}$.	**5.** $3.2\frac{1}{2}$.	**8.** $1.3\frac{1}{4}$.	**11.** $1\frac{1}{2}$.	**14.** $2.05\frac{1}{2}$.
3. $2\frac{1}{4}$.	**6.** $0.32\frac{1}{2}$.	**9.** $1.3\frac{3}{4}$.	**12.** $\frac{1}{4}$.	**15.** $3.5\frac{1}{4}$.

At the following prices per 100, find the cost of one article:

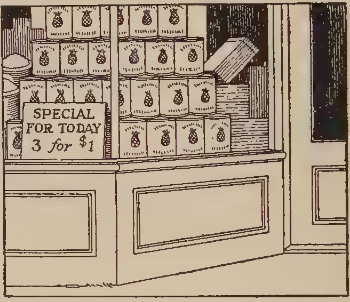
16. \$5. **17.** \$7. **18.** \$2.50. **19.** \$7.50. **20.** \$17.50.

At the following prices per 1000, find the cost of one article:

21. \$15. **22.** \$25. **23.** \$125. **24.** \$250. **25.** \$3750.

A SILENT READING LESSON

Mrs. Edwards can buy canned pineapples at 35¢ a can or at 3 cans for \$1. If she pays \$1 for 3 cans, she pays $\frac{1}{3}$ of \$1 for 1 can. Since $\frac{1}{3}$ of \$1 is $33\frac{1}{3}$¢, she saves a little when she buys 3 cans for \$1.



We often have to use parts of \$1 in just such cases as this, although in this case we could not pay exactly $33\frac{1}{3}$¢ in a single amount, because there is no coin with the value $\frac{1}{3}$¢.

The following table shows fifteen different parts of \$1, which, together with such cases as $1¢ = \frac{1}{100}$ of \$1 and $10¢ = \frac{1}{10}$ of \$1, are the ones most used in practical work:

5¢ = $\frac{1}{20}$ of \$1	**20¢ = $\frac{1}{5}$ of \$1**	**$62\frac{1}{2}$¢ = $\frac{5}{8}$ of \$1**
$6\frac{1}{4}$¢ = $\frac{1}{16}$ of \$1	**25¢ = $\frac{1}{4}$ of \$1**	**$66\frac{2}{3}$¢ = $\frac{2}{3}$ of \$1**
$8\frac{1}{3}$¢ = $\frac{1}{12}$ of \$1	**$33\frac{1}{3}$¢ = $\frac{1}{3}$ of \$1**	**75¢ = $\frac{3}{4}$ of \$1**
$12\frac{1}{2}$¢ = $\frac{1}{8}$ of \$1	**$37\frac{1}{2}$¢ = $\frac{3}{8}$ of \$1**	**$83\frac{1}{3}$¢ = $\frac{5}{6}$ of \$1**
$16\frac{2}{3}$¢ = $\frac{1}{6}$ of \$1	**50¢ = $\frac{1}{2}$ of \$1**	**$87\frac{1}{2}$¢ = $\frac{7}{8}$ of \$1**

There are other parts, such as $60¢ = \frac{3}{5}$ of \$1, but they are not often used.

Suppose that Fred can buy paper pads in quantities of four or more at $12\frac{1}{2}$¢ each. To find the cost of 16 pads, it is much easier to find the value of $16 \times \$\frac{1}{8}$, which is \$2, than to find the value of $16 \times 12\frac{1}{2}$¢. If you do not think so, multiply in each case.

Using Fractional Parts. 1. At the rate of 3 for \$1, or $33\frac{1}{3}$¢ each, how much will 20 collars cost?

We have $20 \times \$\frac{1}{3} = \$\frac{20}{3} = \$6\frac{2}{3} = \$6.66\frac{2}{3}$.

We give such a result to the nearest cent; that is, the cost of the 20 collars is \$6.67.

2. At 6 for \$1, how much will 15 bottles of ink cost?

We have $15 \times \$\frac{1}{6} = \$2\frac{1}{2} = \$2.50$.

3. At $\$1.12\frac{1}{2}$ each, how much will 7 doormats cost?

Since $\$1.12\frac{1}{2} = \$1\frac{1}{8}$,

we have $7 \times \$1\frac{1}{8} = \$7\frac{7}{8} = \$7.87\frac{1}{2}$.

The cost of the 7 mats is therefore \$7.88.

Always count $\frac{1}{2}$¢ or more as a whole cent in such cases.

PARTS OF A DOLLAR

1. At the rate of 3 for \$1, how much must a school pay for 26 spelling books? for 228 spelling books?

2. At the rate of 6 for \$1, how much must a school pay for 160 boxes of crayons? for 112 boxes of crayons?

3. At $33\frac{1}{3}$¢ each, find the cost of 75 handkerchiefs.

4. At $\$1.33\frac{1}{3}$ a book, find the cost of 124 books.

5. At $\$1.12\frac{1}{2}$ a yard, find the cost of 128 yd. of velvet.

Multiply $\$0.33\frac{1}{3}$ and $\$0.66\frac{2}{3}$ by each of these numbers:

6. 42. 7. 66. 8. 78. 9. 96. 10. 540.

Multiply $\$0.16\frac{2}{3}$ and $\$0.12\frac{1}{2}$ by each of these numbers:

11. 48. 12. 96. 13. 144. 14. 192. 15. 240.

DRILL CHART ON PARTS OF A DOLLAR

Numbers 1 to 17, oral

1. At 3 for \$2, how much will 1 necktie cost?
2. At 8 for \$5, how much will 1 rosebush cost?
3. At 8 for \$7, how much will 1 arithmetic cost?

Multiply as follows:

4. $6 \times 33\frac{1}{3}$¢.	8. $18 \times 16\frac{2}{3}$¢.	12. 48×50¢.
5. $8 \times 6\frac{1}{4}$¢.	9. 45×20¢.	13. $8 \times 62\frac{1}{2}$¢.
6. $12 \times 8\frac{1}{3}$¢.	10. $9 \times 33\frac{1}{3}$¢.	14. $9 \times 66\frac{2}{3}$¢.
7. $16 \times 12\frac{1}{2}$¢.	11. $8 \times 37\frac{1}{2}$¢.	15. $6 \times 83\frac{1}{3}$¢.

16. At $87\frac{1}{2}$¢ each, how much will 16 plates cost?
17. At $83\frac{1}{3}$¢ each, how much will 36 pitchers cost?

Multiply as follows:

18. 120×5¢.	25. $64 \times 37\frac{1}{2}$¢.	32. $60 \times 8\frac{1}{3}$¢.
19. $32 \times 6\frac{1}{4}$¢.	26. 75×50¢.	33. $72 \times 12\frac{1}{2}$¢.
20. $48 \times 8\frac{1}{3}$¢.	27. $72 \times 62\frac{1}{2}$¢.	34. $99 \times 33\frac{1}{3}$¢.
21. $48 \times 12\frac{1}{2}$¢.	28. $93 \times 66\frac{2}{3}$¢.	35. $88 \times 37\frac{1}{2}$¢.
22. $48 \times 16\frac{2}{3}$¢.	29. 64×75¢.	36. $176 \times 37\frac{1}{2}$¢.
23. 75×20¢.	30. $78 \times 83\frac{1}{3}$¢.	37. $126 \times 83\frac{1}{3}$¢.
24. 96×25¢.	31. $72 \times 87\frac{1}{2}$¢.	38. $75 \times 62\frac{1}{2}$¢.

Find the number of cents in

39. $\frac{1}{16}$ of \$1.	41. $\frac{5}{16}$ of \$1.	43. $\frac{1}{32}$ of \$1.
40. $\frac{5}{12}$ of \$1.	42. $\frac{7}{16}$ of \$1.	44. $\frac{3}{32}$ of \$1.

Short Cuts in Division. From the work on pages 144 and 145 we can now learn a few more short cuts that will make our work easier.

Just as	5¢ is \$0.05, or $\frac{1}{20}$ of \$1,
so	0.05 is the same as $\frac{1}{20}$,
and	$0.06\frac{1}{4}$ is the same as $\frac{1}{16}$.

That is, the table on page 144 may be written like this:

$0.05 = \frac{1}{20}$	$0.12\frac{1}{2} = \frac{1}{8}$	$0.25 = \frac{1}{4}$	$0.50 = \frac{1}{2}$	$0.75 = \frac{3}{4}$
$.06\frac{1}{4} = \frac{1}{16}$	$.16\frac{2}{3} = \frac{1}{6}$	$.33\frac{1}{3} = \frac{1}{3}$	$.62\frac{1}{2} = \frac{5}{8}$	$.83\frac{1}{3} = \frac{5}{6}$
$.08\frac{1}{3} = \frac{1}{12}$	$.20 = \frac{1}{5}$	$.37\frac{1}{2} = \frac{3}{8}$	$.66\frac{2}{3} = \frac{2}{3}$	$.87\frac{1}{2} = \frac{7}{8}$

Then, instead of dividing by 0.05, we may divide by $\frac{1}{20}$, which is the same as multiplying by 20. Thus, it is much easier to think $18 \times 20 = 360$ than $18 \div 0.05 = 360$.

SHORT CUTS IN DIVISION

1. Instead of dividing by $0.08\frac{1}{3}$, we may simply multiply by what whole number?

2. Instead of dividing by $0.37\frac{1}{2}$, or 0.375, we may multiply by what fraction? Divide 3 by $0.37\frac{1}{2}$ mentally.

Divide mentally each of the following numbers by $0.33\frac{1}{3}$:

3. 7. **4.** 9. **5.** 11. **6.** 2.1. **7.** 1.2. **8.** 70.

Divide mentally each of the following numbers by 0.75:

9. 3. **10.** 6. **11.** 9. **12.** 12. **13.** 30. **14.** 60.

Divide as rapidly as you can:

15. $0.2\overline{)26}$ **16.** $0.16\frac{2}{3}\overline{)72}$ **17.** $0.83\frac{1}{3}\overline{)75}$ **18.** $0.87\frac{1}{2}\overline{)63}$

WRITTEN REVIEW

1. When an automobile speedometer registers as here shown, it means that the car has gone 721.6 mi. Since a mile is 5280 ft., this is how many feet more than 721 mi.?

0	0	7	2	1	6

2. If our speedometer registered 721.6 mi. at the start of a day's trip, and 850.8 mi. at the end, how far did the car go?

3. If a speedometer registered 1078.2 mi. this morning and 1203.6 mi. tonight, how far has the car gone today?

4. If our speedometer registers 2079.4 mi. when our car is 98.7 mi. from a city, what should the speedometer register when we reach the city?

At the following prices per 100, find the cost of one article:

5. \$24.	**8.** \$45.00.	**11.** \$1.	**14.** \$5000.
6. \$240.	**9.** \$4500.	**12.** \$1.1.	**15.** \$50.00.
7. \$2400.	**10.** \$1.25.	**13.** \$1250.	**16.** \$500.00.

At the following prices per 1000, find the cost of one article:

17. \$350.	**18.** \$3.50.	**19.** \$7500.	**20.** \$820.00.

Perform the following multiplications:

21. $\begin{array}{r} 62.5 \\ \underline{25} \end{array}$ **22.** $\begin{array}{r} 1.25 \\ \underline{10} \end{array}$ **23.** $\begin{array}{r} 1350 \\ \underline{3.14} \end{array}$ **24.** $\begin{array}{r} 22,636 \\ \underline{0.33\frac{1}{3}} \end{array}$

Perform the following divisions:

25. $625 \div 25.$	**27.** $144 \div 1.2.$	**29.** $37.5 \div 75.$
26. $0.625 \div 2.5.$	**28.** $1.44 \div 0.12.$	**30.** $3.75 \div 0.75.$

Bill. If goods are not paid for at the time they are purchased, the dealer usually sends a *bill*. Here is a model bill, receipted by the dealer to show that it has been paid:

Mr. James W. Lothrop
24 Cobb Street City

ATLANTA, GA., May 9 1928

Bought of HAMILTON & FROST
DEALERS IN SPORTING GOODS
8371 SOUTH STREET

May	9	2 tennis rackets	8.25	16	50		
		6 tennis balls	.50	3	00		
						19	50

RECEIVED PAYMENT
MAY 12, 1928
HAMILTON & FROST
Per JBM

MAKING OUT BILLS

Make out bills for the following items, inserting dates and names of purchasers and dealers, and receipt the bills:

1. 1 baseball cap, 80¢; 1 catcher's mitt, \$2.80; 1 baseball mask, \$2.75; 1 catcher's body protector, \$3.85.

2. 1 league ball, \$1.35; 3 bats @ \$1.20; 2 fielder's mitts @ \$1.53; 3 canvas bases @ \$2.40; 1 pitcher's toe plate, 45¢.

3. 4 hunting caps @ 80¢; 1 hunting vest, \$2.25; 2 pr. corduroy hunting pants @ \$4.45; 2 hunting coats @ \$4.80.

4. 3 tennis rackets @ \$7.75; 3 racket cases @ \$1.35; 2 racket presses @ \$1.75; $\frac{3}{4}$ doz. balls @ \$4.80.

Price List. Here is a price list of articles which boys and girls may wish to buy:

Baseball bat . . .	$1.25	Hammock	$4.50
Basket ball . . .	5.25	Rubber-stamp outfit	1.75
Bicycle	32.75	School shoes . . .	4.25
Book satchel . . .	1.25	Scout camera . .	5.25
Catcher's mask . .	3.50	Skating cap . . .	2.00
Catcher's mitt . .	2.50	Storm-proof boots .	4.75
Drawing set . . .	.60	Sweater	2.90
Football	2.50	Typewriter . . .	12.50
Football pants . .	3.25	Watch	4.25

Use this price list in the problems on this page or in other problems that you make up.

BUYING FROM A PRICE LIST

Make out bills for the following purchases:

1. 2 sweaters, 3 skating caps, and a watch.

2. A bicycle, a sweater, a baseball bat, a catcher's mask, and 2 catcher's mitts.

3. A rubber-stamp outfit, a typewriter, a scout camera, and a drawing set.

4. 4 pairs of football pants and 2 footballs.

5. A watch, a pair of storm-proof boots, a book satchel, 2 pairs of school shoes, and a hammock.

6. 4 baseball bats, 2 catcher's masks, a basket ball, a catcher's mitt, and 2 pairs of football pants.

7. A watch, a typewriter, a book satchel, a scout camera, and a skating cap.

Marketing. Here is a price list of groceries such as you might use if you were running a house:

Alaska salmon . . .	22¢ per can
Corn sirup	26¢ per $1\frac{1}{2}$-pound can
Cornstarch	16¢ per package
Graham flour . . .	25¢ per package
Hominy	7¢ per pound
Potato flour	18¢ per package
Rye flour	6¢ per pound
White flour	$1.35 per sack
Yellow corn meal . .	6¢ per pound

You may use this price list in the problems on this page. A better way is to find the prices of these articles at some grocery and write them on the board for the class to use.

MARKETING

Make out bills for the following purchases:

1. 1 sack of white flour and 3 packages of potato flour.

2. 10 lb. of rye flour and 6 lb. of yellow corn meal.

3. 8 packages of cornstarch and 12 lb. of hominy.

4. 2 packages of cornstarch, 6 cans of Alaska salmon, 8 packages of potato flour, and a sack of white flour.

5. 5 cans of corn sirup, 5 lb. of rye flour, 10 lb. of hominy, and 9 lb. of yellow corn meal.

6. 11 lb. of hominy, 7 packages of potato flour, 12 cans of Alaska salmon, and a sack of white flour.

7. 3 packages of graham flour, 2 sacks of white flour, and 4 packages of cornstarch.

Buying at a Sale. Often, at special sales, merchants offer goods at "$\frac{1}{4}$ off," at "$\frac{1}{3}$ off," or at other reductions in price. For example, at "$\frac{1}{4}$ off," a tennis racket marked $3.60 will cost $3.60 less $\frac{1}{4}$ of $3.60, which is $3.60 – $0.90, or $2.70.

	$3.60
Less $\frac{1}{4}$,	.90
	$2.70

Similarly, a nickel watch that is advertised at $4.50, with "$\frac{1}{3}$ off," can be bought for $4.50 less $\frac{1}{3}$ of $4.50, which is $4.50 – $1.50, or $3.

BUYING AT A SALE

Find the cost at "$\frac{1}{4}$ off" of articles marked as follows:

1. Phonograph, $52.40.
2. Typewriter, $36.80.
3. Boy-Scout suit, $6.40.
4. Nickel watch, $4.80.
5. Baseball mitt, $1.60.
6. Fishing rod, $2.40.

Find the cost at "$\frac{1}{3}$ off" of articles marked as follows:

7. Fishing reel, $2.40.
8. Baseball bat, $1.50.
9. Boy's sweater, $3.15.
10. Camera, $6.75.
11. Phonograph, $48.
12. Basket ball, $5.25.

13. A dealer pays $330 for some percaline at 25¢ a yard. How many yards of percaline does he buy?

14. If 4 tennis rackets cost $17.20, how much will 2 rackets cost? Solve by one division.

15. If 12 fishing reels cost $31.20, how much will 4 fishing reels cost? How much will 6 fishing reels cost?

16. If 3 cameras cost $27.75, how much will 4 cameras cost? Solve by one multiplication by a mixed number.

USING WHAT YOU HAVE LEARNED

1. How much will 25 phonographs cost at $52.40 each?

2. How much will 38 typewriters cost at $72.50 each?

3. How much must a school pay for 64 manual-training benches at $18.50 each?

4. How much will 96 yd. of silk cost at $2.25 a yard?

5. How much will 75 yd. of voile cost at $1.60 a yard?

6. How much must a school pay for 20 jack planes at $2.60 each? at $2.75 each? at $3.25 each?

7. How much will 24 yd. of cloth cost at 87½¢ a yard?

8. How much will 240 door catches cost at 35¢ each?

9. How much will 96 yd. of cloth cost at $1.25 a yard?

10. A dealer pays $360 for some gingham at 60¢ a yard. How many yards of gingham does he buy?

11. In going from New York to Baltimore, a distance of 186.9 mi., the train passes through Trenton, which is 58.0 mi. from New York. How far is it from Trenton to Baltimore?

12. A train leaving St. Louis at 8 19 A.M. reaches Louisville, which is 273.7 mi. from St. Louis, at 6 35 P.M. Find the average speed at which the train travels per hour, remembering that 8 19 A.M. means 8 hr. 19 min. in the morning, and 6 35 P.M. means 6 hr. 35 min. in the evening.

13. In traveling from Boston to New Haven, a distance of 156.8 mi., we pass through Providence, which is 43.8 mi. from Boston. From Boston to Providence is how much less than half the distance from Boston to New Haven?

14. One train leaves Charleston at 6 40 A.M. and arrives at Toledo, which is 326.5 mi. from Charleston, at 6 56 P.M. Another train leaves Toledo at 11 05 A.M. and arrives at Charleston at 9 05 that evening. Find the average speed of each train per hour.

15. On an automobile trip of 120.4 mi. a man stops for luncheon when the speedometer registers 46.9 mi. What part of the trip has he made when he stops for luncheon?

16. Two cousins, Frank and Tom, are visiting their uncle in Chicago. Frank lives in Gary, which is 26.3 mi. from Chicago; Tom lives in Sandusky, which is 292.5 mi. from Chicago. Tom says Sandusky is twelve times as far from Chicago as Gary is, but Frank says it lacks about 20 mi. of it. Which boy is right?

17. A boy who earns $8.50 a week pays 12¢ for car fares and 30¢ for luncheon each week day. Once a week he pays 15¢ for a ticket to the movies, and on Saturdays he pays 50¢ for a ticket to the ball game. His other expenses are 60¢ each week. How much does he save in 8 wk.?

18. Except for 8 holidays, the schools of a certain city are in session 5 da. a week for 39 wk. and 4 da. If a boy goes to school every day it is in session, how many days is he in school?

19. During the summer vacation a boy works 10 wk. in an office. He goes to and from the office in the street cars, and the fare is 7¢ each way. If he works every week day except the Fourth of July, to how much do his car fares amount? The previous summer the car fare was 5¢ each way. How much does the increase cost him?

III. MEASURES

A SILENT READING LESSON

We know how the common measures, such as feet, inches, pounds, and so on, are used. We measure cloth by the yard, the length of a page like this in inches, the length of a room in feet and inches, and the length of an automobile trip in miles. We measure our weight in pounds, milk by the quart, apples in an orchard by the bushel, and time by minutes, hours, years, and so on.

Sometimes we speak of numbers like 4 lb., 16 ft., and \$10 as *denominate numbers*, and of numbers like 4 ft. 2 in. and 10 lb. 3 oz. as *compound numbers*. To know how to use compound numbers is important in only a few cases, because they are now rarely used in practical work.

When we change the name of a number from feet to inches, we say that we *reduce* from feet to inches.

The following cases show how we make such reductions; for example, suppose that we are required to change $8\frac{1}{2}$ ft. to inches.

We first see that

$$1 \text{ ft.} = 12 \text{ in.}$$

$$\boxed{\begin{aligned} 1 \text{ ft.} &= 12 \text{ in.} \\ 8\tfrac{1}{2} \text{ ft.} &= 8\tfrac{1}{2} \times 12 \text{ in.} \\ &= 102 \text{ in.} \end{aligned}}$$

Then, proceeding as shown above, the result is 102 in.

Similarly, to change 102 in. to feet, we first see that

$$1 \text{ in.} = \tfrac{1}{12} \text{ ft.}$$

We then proceed as shown in the work at the right.

$$\boxed{\begin{aligned} 1 \text{ in.} &= \tfrac{1}{12} \text{ ft.} \\ 102 \text{ in.} &= 102 \times \tfrac{1}{12} \text{ ft.} \\ &= 8\tfrac{1}{2} \text{ ft.} \end{aligned}}$$

Table of Length. Review the following table of length:

12 inches (in.) = 1 foot (ft.)
3 feet = 1 yard (yd.)
$5\frac{1}{2}$ yards, or $16\frac{1}{2}$ feet = 1 rod (rd.)
320 rods, or 5280 feet = 1 mile (mi.)

REVIEW OF THE TABLE OF LENGTH

1. If you live $\frac{1}{4}$ mi. from your school, how many feet do you go in walking to school? in walking to school and walking home?

2. In Ex. 1 how many yards do you walk?

Find the number of inches in each of the following lengths:

3. $2\frac{1}{2}$ ft. **4.** $3\frac{3}{4}$ ft. **5.** $16\frac{1}{2}$ ft. **6.** $\frac{1}{2}$ yd. **7.** $1\frac{3}{4}$ yd.

Find the number of feet in each of the following lengths:

8. 9 rd. **9.** $6\frac{1}{2}$ yd. **10.** 15 yd. **11.** 2 rd. **12.** $\frac{3}{4}$ mi.

13. If I buy $3\frac{3}{4}$ yd. of tape, how many inches do I buy?

14. Express in feet the length of a field 40 rd. long.

15. The distance between two railway stations is known to be $9\frac{3}{4}$ mi. Express the distance in miles and feet.

16. In time-tables the distances between stations are sometimes given in decimals to the nearest 0.01 mi. A distance of 22.75 mi. is how many feet more than 22 mi.?

Express the following as miles and feet:

17. 2.8 mi. **19.** 3.65 mi. **21.** 5.85 mi.

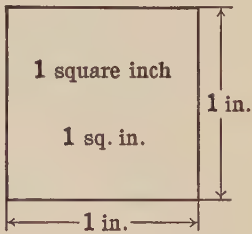
18. 2.25 mi. **20.** 4.35 mi. **22.** 0.72 mi.

23. Which is the longest, 17 rd., $93\frac{1}{2}$ yd., or $280\frac{1}{2}$ ft.?

Table of Square Measure. Review the following table:

144 square inches (sq. in.)	**= 1 square foot (sq. ft.)**
9 square feet	**= 1 square yard (sq. yd.)**
$30\frac{1}{4}$ square yards	**= 1 square rod (sq. rd.)**
160 square rods	**= 1 acre (A.)**
640 acres	**= 1 square mile (sq. mi.)**

If a square is 1 in. on a side, it is 1 in. square, and we say that its *area* is 1 sq. in.



If a square is 1 ft. on a side, it is 1 ft. square, and its area is 1 sq. ft.

If a square is 1 yd. on a side, its area is 1 sq. yd., and so on.

Carpenters, architects, and draftsmen often write **8″** for 8 in., **5′** for 5 ft., and **6′ 7″** for 6 ft. 7 in.

REVIEW OF SQUARE MEASURE

1. Find the number of square inches in the top of a desk which has an area of $3\frac{1}{2}$ sq. ft.

2. A school blackboard has an area of $4\frac{1}{2}$ sq. yd. What is the area in square feet?

3. A flower bed has an area of 2 sq. rd. What is the area in square yards? in square feet?

4. Find the number of square feet in 7 sq. yd.

Copy, and supply the missing numbers:

5. 18 sq. ft. = —— sq. yd.	**8.** $\frac{1}{2}$ A. = —— sq. rd.
6. 18 sq. yd. = —— sq. ft.	**9.** $2\frac{1}{2}$ sq. mi. = —— A.
7. 4 sq. rd. = —— sq. yd.	**10.** $2\frac{1}{2}$ A. = —— sq. rd.

MEASURING AND DRAWING

1. Measure this page of the arithmetic. Draw a plan of the page to the scale $\frac{1}{4}$. This means that we represent 1″ on the page by $\frac{1}{4}$″ on the plan that we draw. If the page is $7\frac{1}{4}$″ long, the length of the plan will be $7\frac{1}{4} \times \frac{1}{4}$″. You can easily find this length on your ruler.

2. Measure the top of your desk. Draw a plan to the scale of 1″ to 1′.

3. Draw a plan of the top of your desk to the scale $\frac{1}{8}$.

4. Measure the length and width of the schoolroom. Draw a plan to scale and write below it the scale used.

5. Measure the size of the paper upon which you make your drawings. Draw a plan of a sheet to the scale $\frac{1}{8}$.

6. Measure the size of any other book you are studying. Draw a plan of a page to the scale $\frac{1}{4}$.

7. Roy made a drawing of a box cover. The cover was 14″ long, and the drawing $3\frac{1}{2}$″. What scale was used?

8. A drawing of a floor 24″ long and 20″ wide is 6″ long and 5″ wide. What scale was used?

9. A rectangle 2″ by 3″ has an area of 6 sq. in. Draw such a rectangle. Then draw a rectangle 4″ by 6″, and see if you can tell the area of the second one. Using a scale twice as large does what to the area?

10. A very common scale is 3″ to 1′, which is the same as the scale $\frac{1}{4}$. It is often spoken of as "$\frac{1}{4}$ full size." The scale $1\frac{1}{2}$″ to 1′ is called "$\frac{1}{8}$ full size." What part of an inch to 1′ would be called "$\frac{1}{16}$ full size"?

Table of Weight. Review the following table of weight:

16 ounces (oz.) = 1 pound (lb.)
100 pounds = 1 hundredweight (cwt.)
2000 pounds = 1 ton (T.)

REVIEW OF MEASURES OF WEIGHT

Numbers 1 to 3, oral

1. If you buy $\frac{1}{2}$ lb. of tea, you buy how many ounces?

2. A man buys $\frac{1}{2}$ T. of coal. This is how many pounds?

3. In 4000 lb. of coal how many tons are there?

Find the number of pounds in

4. 2 cwt.	**9.** $\frac{1}{2}$ T.	**14.** 0.1 T.	**19.** 0.25 T.
5. $\frac{1}{2}$ cwt.	**10.** 2 T.	**15.** 2.1 T.	**20.** 2.25 T.
6. $2\frac{1}{2}$ cwt.	**11.** $2\frac{1}{2}$ T.	**16.** 2.2 T.	**21.** 9.25 T.
7. $3\frac{1}{4}$ cwt.	**12.** $3\frac{1}{2}$ T.	**17.** 3.5 T.	**22.** 8.75 T.
8. $4\frac{3}{4}$ cwt.	**13.** $5\frac{1}{2}$ T.	**18.** 4.5 T.	**23.** 6.75 T.

Find the number of tons in

24. 2000 lb.	**27.** 500 lb.	**30.** 1500 lb.	**33.** 20 cwt.
25. 6000 lb.	**28.** 4500 lb.	**31.** 3500 lb.	**34.** 10 cwt.
26. 8000 lb.	**29.** 6500 lb.	**32.** 5500 lb.	**35.** 15 cwt.

Find the number of ounces in

36. $\frac{1}{2}$ lb. **37.** $2\frac{1}{2}$ lb. **38.** $\frac{1}{4}$ lb. **39.** $3\frac{1}{4}$ lb. **40.** $\frac{3}{4}$ lb.

Find the number of pounds in

41. 32 oz. **42.** 8 oz. **43.** 40 oz. **44.** 64 oz. **45.** 72 oz.

Table of Liquid Measure. Review the following table:

2 pints (pt.) = 1 quart (qt.)
4 quarts = 1 gallon (gal.)

REVIEW OF LIQUID MEASURE

Numbers 1 to 4, oral

1. If Mr. Russell buys 1 qt. of oil for his car, how many pints of oil does he buy?

2. Name the measures in the above picture.

3. If Mr. Russell buys $1\frac{1}{2}$ qt. of oil, how many pints does he buy? This is what part of a gallon?

4. If a can holds 10 gal., how many quarts does it hold?

Find the number of pints in

5. $2\frac{1}{2}$ qt. 6. $8\frac{1}{2}$ qt. 7. $\frac{1}{2}$ gal. 8. $7\frac{1}{2}$ gal. 9. $4\frac{1}{4}$ qt.

Find the number of quarts in

10. 16 pt. 11. 17 pt. 12. $\frac{1}{2}$ gal. 13. $9\frac{1}{2}$ gal. 14. $10\frac{3}{4}$ gal.

Table of Dry Measure. Review this table of dry measure:

2 pints (pt.) = 1 quart (qt.)
8 quarts = 1 peck (pk.)
4 pecks = 1 bushel (bu.)

The present tendency is to sell all sorts of produce by weight. The weight of a bushel of a commodity like potatoes or beans is fixed by state laws.

REVIEW OF DRY MEASURE

1. Name the three measures in the above picture.

Find the number of pints in

2. 2 qt. **3.** $\frac{1}{2}$ qt. **4.** $7\frac{1}{2}$ qt. **5.** 1 pk. **6.** $3\frac{1}{2}$ pk.

Find the number of quarts in

7. 4 pt. **8.** 9 pt. **9.** $\frac{3}{4}$ pk. **10.** $7\frac{1}{2}$ pk. **11.** $2\frac{1}{2}$ bu.

Find the number of pecks in

12. 16 pt. **13.** 16 qt. **14.** $3\frac{1}{2}$ bu. **15.** $9\frac{1}{2}$ bu.

Find the number of bushels in

16. 32 qt. **17.** 32 pk. **18.** 32 pt. **19.** 64 pk.

Table of Time. Review the following table of time:

60 seconds (sec.) = 1 minute (min.)
60 minutes = 1 hour (hr.)
24 hours = 1 day (da.)
7 days = 1 week (wk.)
12 months (mo.) = 1 year (yr.)

Common years have 365 da., and *leap* years have 366 da. Years whose numbers are divisible by 4, but not by 100, and those divisible by 400, are leap years. Thus, 1928 and 1932, but not 2100, are leap years.

April, June, September, and November have 30 da. each; the others have 31 da., except February, which has 28 da. in a common year and 29 da. in a leap year.

REVIEW OF MEASURES OF TIME

Find the number of minutes in

1. $\frac{1}{2}$ hr. 2. 120 sec. 3. $1\frac{1}{4}$ hr. 4. $1\frac{1}{2}$ hr.

Find the number of hours in

5. $1\frac{1}{2}$ da. 6. 180 min. 7. $2\frac{1}{2}$ da. 8. $2\frac{1}{4}$ da.

9. How many minutes are there from 11 30 A.M. to 2 15 P.M.; that is, from 11 hr. 30 min. (half past 11) in the morning to 2 hr. 15 min. (quarter past 2) in the afternoon?

Find the number of minutes from

10. 10 20 A.M. to 11 10 A.M.; 11 45 A.M. to 12 15 P.M.
11. 10 min. before 10 P.M. to 20 min. after 10 P.M.
12. 10 min. after 9 A.M. to 10 min. before 11 A.M.
13. Find the number of minutes in your school day.

Table of Money. Review the following table of money:

10 mills	= 1 cent (ct. or ¢)
5 cents	= 1 nickel
10 cents	= 1 dime
25 cents	= 1 quarter dollar
50 cents	= 1 half dollar
100 cents	= 1 dollar
10 dimes	= 1 dollar ($)

The mill is not coined, but is frequently used in business calculations. The ten-dollar gold piece is sometimes called an *eagle.*

Table of Dozens. This table is often used in counting:

12 units	= 1 dozen (doz.)
12 dozen	= 1 gross (gr.)

REVIEW OF MONEY AND COUNTING

1. How many oranges do you buy when you buy 3 doz.? $3\frac{1}{2}$ doz.? 5 doz.? $5\frac{1}{4}$ doz.?

2. How many eggs are $2\frac{1}{2}$ doz. eggs? $3\frac{3}{4}$ doz. eggs?

3. If a dressmaker buys 2 gr. of buttons, she buys how many dozen? how many buttons?

4. If, when you buy 1 doz. buttons, you hand the clerk a half dollar and receive 2¢ in change, how much do you pay for each button?

5. If you pay 3 dimes, a nickel, and a cent for $\frac{1}{2}$ doz. large buttons, how much do you pay for each button?

6. Which is more, 6 doz. dozen or a half a dozen dozen? How many units are there in each?

USING WHAT YOU HAVE LEARNED

1. How many 5-rod spaces are there in 1 mi. of telegraph poles placed 5 rd. apart? How many poles are there, including the first pole and the last?

2. Our train arrives at 1 07 P.M. It is now 11 56 A.M. How long have we to wait?

3. Instead of arriving at 11 45 A.M., a train arrived at 12 25 P.M. How late was it?

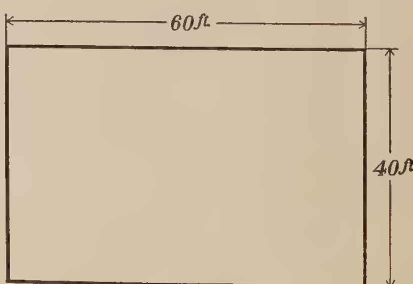
4. A school garden is 5 rd. long and 3 rd. wide. Find the perimeter (the distance around the garden) in feet.

5. At $9.60 a gross, how much will a dozen lamp shades cost? How much will $7\frac{1}{2}$ doz. cost?

6. A dealer buys 45 gr. (gross) of blackboard erasers of which $\frac{1}{10}$ are damaged. How many erasers are damaged?

7. Which is cheaper, to buy a gross of articles for $108 or 12 doz. at $9.50 a dozen? How much cheaper is it?

8. A school garden is 60 ft. long and 40 ft. wide. This picture is a plan of the garden to the scale of $\frac{1}{32}$ in. to 1 ft. Express the size of the garden in yards.



9. How many feet of fencing will be needed to inclose the garden? How many yards?

10. Draw a plan of a garden that is 20 ft. long and 15 ft. wide, using the scale of 1 in. to 10 ft.

A SILENT READING LESSON

Most of the problems we have had thus far have been of the kind that we could solve without much difficulty. As the problems become a little harder, we shall need to know how to think them through so as to be able to solve them. It will help us to consider these things in each case:

1. Just what is given?
2. Just what are we to find?
3. With what is given, how shall we go to work?

Let us see how this works with an example. Suppose that a man buys 5 T. 1200 lb. of coal. If he uses 100 lb. a day, how many days will the coal last?

1. Just what is given? Two things: (1) the weight of all the coal, and (2) the weight of the coal used each day.

2. Just what are we to find? The number of days the coal will last.

3. How shall we go to work? If we had 10 lb. of coal and used 2 lb. a day, we should have $10 \div 2 = 5$; that is, the coal would last 5 da. We therefore see that we must divide 5 T. 1200 lb. by 100 lb.

If we had the weight in pounds, this would be easy. We therefore write 5 T. 1200 lb. as 10,000 lb. + 1200 lb., or 11,200 lb.

We then divide 11,200 lb. by 100 lb., or 11,200 by 100, and the result is 112, the number of days.

If a problem concerns measuring a rectangle, a triangle, a distance, or some similar case, we should draw a plan which shows clearly what is given and what is to be found.

MISCELLANEOUS PROBLEMS

1. How many tulip bulbs, placed 6 in. apart, will it take for 4 rows, each 8 ft. long? Draw a plan of the first row and find the number needed for that row.

2. A farmer raises 1950 bu. of wheat on 95 A. If he can increase the crop one half by better farming methods, what will be the yield per acre?

3. The boys in the class measured a building lot near the school. One side was 175.2 ft., the next was 83.4 ft., the third was 196.5 ft., and the fourth was also 83.4 ft. How far was it around the lot?

4. A train schedule provides 10 round trips to the city each week day and 4 round trips on Sunday from a certain suburban station. In 4 wk. the trains travel a total of 6144 mi. How far from the city is the suburban station from which the trains start?

5. A workman's time slip showed that at the end of the week he had worked 44 hr. He was paid at the rate of 62¢ an hour. How much money did he receive at the end of the week and how many 8-hour days had he worked?

6. A factory which employs 428 men runs 8 hr. a day 5 da. in the week and 4 hr. on Saturday. The men are paid at the rate of 75¢ an hour. Owing to poor business, the working hours had to be reduced to 24 hr. per week. How much did the men lose in wages each week?

7. A newsboy pays 3¢ for a weekly magazine that he sells for 5¢. How many must he sell in order to make $8 more than the cost of the magazines?

IV. REVIEW AND DRILL

MINIMUM ESSENTIALS

Copy, add, and check the results:

1.	2.	3.	4.
\$941.35	\$910.45	\$590.05	\$783.60
598.38	207.98	232.68	55.62
2.98	700.00	329.87	454.08
79.26	56.50	762.45	384.96
563.42	862.73	82.74	672.00
802.75	426.37	538.73	586.49
508.72	758.42	457.07	754.62

Perform the following operations involving fractions:

5. $\frac{3}{4}$ of $\frac{5}{9}$.

6. $\frac{3}{4} \div \frac{9}{16}$.

7. $\frac{7}{8} + \frac{3}{4}$.

8. $\frac{7}{8} - \frac{3}{4}$.

9. $6\frac{2}{3} \times 9\frac{3}{8}$.

10. $\frac{2}{5}$ of $\frac{15}{16}$.

11. $4\frac{1}{8} - \frac{1}{4}$.

12. $3\frac{5}{8} + 2\frac{15}{16}$.

13. $3\frac{5}{8} - 2\frac{15}{16}$.

14. $2\frac{1}{2} + 1\frac{7}{8}$.

15. $\frac{2}{3} \div \frac{5}{12}$.

16. $3 \times 12\frac{3}{4}$ in.

17. $12\frac{3}{4}$ in. $\div$ 3.

18. $16\frac{3}{4}$ ft. $\div$ 4.

19. $30\frac{3}{5}$ yd. $\div$ 9.

Perform the following operations involving decimals:

20. $2.68 + 1.22$.

21. $2.68 - 1.22$.

22. 1.65×1.5.

23. $1.65 \div 1.5$.

24. $1.27 + 0.68$.

25. $1.27 - 0.68$.

26. 1.27×0.68.

27. $1.50 + 0.02$.

28. $1.50 - 0.02$.

29. 1.50×0.02.

30. $1.50 \div 0.02$.

31. 1.62×2.4.

32. 16.2×24.

33. 162×0.24.

34. 6×3.2 ft.

35. 4×1.3 mi.

36. 12×2.6 in.

37. 24×3.5 ft.

38. 2.4×35 ft.

39. 2.4×0.35 ft.

40. 0.24×35 ft.

PROBLEMS WITHOUT NUMBERS

All work oral

1. If John picked a certain number of quarts of berries today and a certain part as many yesterday, how do you find how many quarts he picked in the two days?

2. If you know the number of decimal places in each of two numbers, how do you find how many decimal places to point off in the result when you multiply the numbers together?

3. If Ethel lives a certain distance from school, and this distance is a certain number of times as far as Kate lives, how do you find how far from school Kate lives?

4. If you know the cost of a certain number of boxes of oranges, how do you find the cost of a certain other number of boxes at the same price per box?

5. If you know the thickness of a sheet of blotting paper to the nearest hundredth of an inch, how can you, without measuring, find the height of a pile containing a certain number of these sheets?

6. If you know the area of a kitchen floor in square feet, how do you find the number of square yards of linoleum needed to cover the floor, making no allowances for waste?

7. If you know the number of square rods in the area of a field, how do you find the number of acres in the field?

8. If you know the capacity of a can in gallons, how do you find the number of quarts it will hold?

9. How do you express a decimal as a fraction? a fraction as a decimal?

PROBLEMS FOR COMPLETION

1. The daily route of a certain rural mail carrier is 36.4 mi. long. He goes over this route 305 times a year. Complete the problem in any reasonable way that you wish and then solve it.

2. On each trip the carrier in Ex. 1 uses 3 gal. of gasoline costing 17¢ a gallon. Complete and solve the problem.

Complete and solve the following problems:

3. In the 305 trips referred to in Ex. 1, the carrier delivered 12,256 letters, each bearing a 2-cent stamp.

4. The school expenses in a country school for 4 mo. were as follows: teacher's salary, \$400; fuel, \$42.80; text-books, \$16.80; repairs, \$18.28; janitor, \$24.72. There were 20 pupils in the school.

5. Charles lives 1.6 mi. from his school. He walks both ways 4 da. in the week, and rides the other school day. There are 20 school days in a certain month.

6. Mr. Gray gave his son John the use of a small piece of land. John raised watermelons on it and sold his crop of 27 melons at an average price of $33\frac{1}{3}$¢ each. His father then gave him enough more to amount to \$10.

7. Mr. Shaw had a crib of corn containing 900 bu. Because he neglected to repair the crib, rats destroyed 25 bu. of corn. The corn was worth 90¢ a bushel.

8. We arrive at Baltimore, where we have to change cars, at 11 57 A.M. Ordinarily, the other train that we take leaves at 2 19 P.M., but it is 35 min. late.

Testing Your Alertness. In arithmetic you must be alert. This test will show how alert you really are.

In the three lines given below, each number is obtained in a certain way from the numbers coming before it. In each line four numbers are given, and you are to supply the fifth number, which is printed in heavy type:

2,	4,	6,	8,	**10**
16,	8,	4,	2,	**1**
15,	13,	10,	6,	**1**

In the first row, 2 is added to each number; in the second, each number is divided by 2; in the third, 2 is subtracted from 15, 3 from 13, 4 from 10, and 5 from 6.

ALERTNESS TEST

Copy the following sets of numbers and insert the fifth number in each line, all in 3 min. from the time you start:

1. 9, 8, 7, 6.

2. 2, 4, 8, 16.

3. 3, 6, 9, 12.

4. 3, 6, 12, 24.

5. 4, 2, 1, $\frac{1}{2}$.

6. 2, 7, 12, 17.

7. 3, 7, 11, 15.

8. 9, 3, 1, $\frac{1}{3}$.

9. $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1.

10. 4, 3, 2, 1.

11. 55, 61, 67, 73.

12. 39, 32, 25, 18.

13. 42, 51, 60, 69.

14. 10, 20, 40, 80.

15. 60, 30, 15, $7\frac{1}{2}$.

16. 3, 4, 3, 4.

17. 5, $7\frac{1}{2}$, 10, $12\frac{1}{2}$.

18. 1, 2, 4, 7.

19. 9, 10, 8, 9.

20. 18, 17, 15, 12.

MISCELLANEOUS PROBLEMS

1. If the fee charged for registering an automobile is 50¢ for each 100 lb. for cars weighing 3500 lb., or less, what will be the cost of registering a car weighing 2800 lb.? 3100 lb.? 3400 lb.? 2600 lb.?

2. For cars weighing over 3500 lb. the registration fee is 50¢ for each 100 lb. up to 3500 lb. and 75¢ for each 100 lb. over 3500 lb. What will be the cost of registering a car weighing 3600 lb.? 3800 lb.? 4100 lb.?

3. Allowing $31\frac{1}{2}$ gal. to a barrel, how many gallons are there in a tank that holds $23\frac{1}{2}$ barrels? How many barrels are there in a tank that holds 7875 gal.?

4. How many automobiles weighing 3200 lb. each will it take to make up a shipment that will weigh 16 T.?

5. If a motor truck uses on an average 75 gal. of gasoline every $3\frac{1}{2}$ da., how much should the driver order for 70 da.?

6. If a business house uses on an average 500 envelopes every 30 da., how long will 3500 envelopes last? How long will 5750 envelopes last?

7. A dressed hog weighed 180 lb. If this was $\frac{3}{4}$ of what it weighed when alive, how much did the hog cost at 20¢ a pound, live weight?

8. If 3 barrels of pork sold for \$153, what is the value of $\frac{3}{4}$ of a barrel?

9. At $8\frac{1}{3}$¢ a pound, how much sugar can you get in exchange for 25 doz. eggs at 52¢ per dozen?

10. A baker bought 3 doz. eggs for \$1.50. If six of them were bad, what did the good eggs cost him per dozen?

ROBERT'S CORN FIELD

1. Robert decides to earn money by raising corn. He rents from his father a field containing 320 sq. rd. At $10 an acre, how much should he charge to expenses as rent?

2. He estimates his labor at 40¢ an hour and the work of a horse at 60¢ an hour. Find the labor cost in a month when he puts in 42 hr., during 4 hr. of which he uses a horse.

3. If he uses 1 qt. of seed corn to 200 hills, how many hills can he plant with 1 pk. of seed?

4. If he plants the hills 3 ft. 4 in. apart, and no hill is nearer than 4 ft. to either end, how many hills can he plant in a row which is 32 rd. long?

5. Robert's field is 10 rd. wide. If he plants the rows 3 ft. 6 in. apart, and no row is nearer to either side than 3 ft. 9 in., how many rows does he plant?

6. On one acre of his land, on which he used fertilizer costing $14, Robert raised 43 bu. On the other acre, without fertilizing, he raised only 24 bu. At 90¢ a bushel, how much did he gain by fertilizing?

A FARM CLUB

1. A boy in a farm club husked all the corn grown on an acre of land. He saved out 7 bu. for seed and sold the rest, which weighed 3225 lb. Allowing 75 lb. to a bushel of new ear corn, how many bushels did the acre yield?

2. In Ex. 1, suppose that the seed corn was worth $3 a bushel, that the ordinary field corn was worth 90¢ a bushel, and that the stalks were worth a quarter as much as the corn itself. Find the value of the crop.

3. The accounts kept by a club boy showed these items:

Rent of land,	$7.00	Husking,	$5.00
Plowing,	2.00	Fertilizing,	7.50
Harrowing,	1.25	Hoeing, 12 hr. @ 44¢,	(?)
Seed,	.91	Cultivating, 3 times @ 60¢,	(?)

If he raised $72\frac{1}{2}$ bu., what was the cost per bushel?

4. A boy finds that if he uses stable fertilizer, which he can get for nothing, a half acre produces corn that will sell for $35. Without the fertilizer the land will produce only $22. Find the gain in income per acre from fertilizing.

5. An average ear of white dent seed corn weighs 12 oz. Allowing 75 lb. to a bushel of new ear corn, how many ears of seed corn are there in a bushel?

6. Some farmers estimate that there are 100 ears of ordinary field corn in a bushel. If 15 ears will plant an acre, how many acres will $3\frac{1}{2}$ bu. plant?

7. The club found that 1 A. of land should produce $64 above all expenses. At this rate, how much should a piece of land containing 120 sq. rd. produce?

V. LITTLE EXAMINATIONS

I. 1. $5\frac{1}{2}$ ft. = (?) in.
2. 25 in. = (?) ft.
3. $7\frac{3}{4}$ lb. = (?) oz.
4. 44 qt. = (?) pk.
5. $3\frac{4}{5} \times 6\frac{2}{3}$.
6. $5 \times 9\frac{3}{4}$ ft.
7. $3\frac{1}{2} \times 7\frac{1}{2}$ ft.
8. $82\frac{1}{2}$ ft. $\div$ 3.

II. 1. $6\frac{3}{4}$ ft. = (?) in.
2. 108 in. = (?) yd.
3. $4\frac{1}{2}$ sq. mi. = (?) A.
4. 61 sq. ft. = (?) sq. yd.
5. $9\frac{2}{3}$ yd. $\div$ 3.
6. $4\frac{7}{8} \times 8\frac{3}{4}$ yd.
7. $8 \times 5\frac{3}{4}$ bu.
8. $103\frac{1}{3} \div 3\frac{1}{3}$.

III. 1. $46\frac{1}{2}$ ft. = (?) yd.
2. 2560 A. = (?) sq. mi.
3. $72\frac{1}{2}$ gal. = (?) qt.
4. 9 sq. ft. = (?) sq. in.
5. $9 \times 7\frac{1}{2}$ lb.
6. $7\frac{3}{4} \times 9\frac{1}{2}$ lb.
7. $16\frac{1}{2} \div 8\frac{1}{4}$.
8. $8\frac{1}{2}$ lb. + $\frac{1}{4}$ lb.

IV. 1. $61\frac{1}{2}$ ft. = (?) yd.
2. 24 A. = (?) sq. rd.
3. $2\frac{1}{4}$ T. = (?) lb.
4. 45 sq. ft. = (?) sq. yd.
5. $17\frac{1}{8} - 9\frac{3}{4}$.
6. $8 \times 5\frac{1}{4}$ ft.
7. $3\frac{7}{8} \times 6\frac{2}{3}$ ft.
8. $31\frac{1}{2}$ ft. $\div$ 6.

V. 1. 16.28×9.79.
2. $16.28 \div 0.04$.
3. $16.28 + 9.79 - 3.99$.
4. $16.28 - 9.79 + 16.22$.
5. $36 \times 16\frac{2}{3}$¢.
6. $84 \times 8\frac{1}{3}$¢.
7. $96 \times 37\frac{1}{2}$¢.
8. $88 \times 62\frac{1}{2}$¢.

VI. 1. 82.75×1.125.
2. $16.25 \div 0.125$.
3. $78.23 + 16.85 - 23.08$.
4. $6.234 - 5.031 + 8.277$.
5. 3.14×6.72.
6. $2.25 \div 1.5$.
7. $2.25 \div 0.15$.
8. $2\frac{1}{2} \times 24.8$.

CHAPTER III

I. REVIEW OF OPERATIONS

A SILENT READING LESSON

We can easily add, subtract, multiply, and divide with whole numbers, or integers as they are also called. We know the combinations that are needed, such as $7 + 8$, $17 - 9$, 8×7, and $72 \div 8$. We also know that $72 \div 8$ may be written as $\frac{72}{8}$, or in other ways, and have learned some things about fractions and decimals.

We can read numbers as far as millions and know that a thousand million is called a billion.

We can solve easy problems and we know that it is necessary to read the problems carefully so as to find out just what is given and just what is required. We can then think out the solution.

We also know that it is a good thing for us to estimate a result in advance so as to avoid obtaining an answer that is absurdly large or absurdly small. We have learned how to check our results so as to be sure that they are right; for example, we know that $51 - 29 = 22$, because $29 + 22 = 51$.

We have just had a vacation, however, and are "a little rusty" in computing. It will be a good plan, therefore, to review our earlier work briefly in order to be sure that we can find results quickly and accurately.

ORAL DRILL CHART IN RAPID ADDITION

State the results of these additions rapidly:

1.	5	2	8	1	4	3	6	9	0	7
	1	0	3	2	3	1	3	0	5	0
2.	9	1	6	0	4	8	2	7	5	3
	1	0	2	0	1	2	2	1	2	0
3.	6	0	4	1	3	2	5	9	7	8
	1	1	2	1	2	1	0	2	2	1
4.	4	6	0	5	1	3	2	8	0	7
	4	0	2	3	3	4	3	0	6	3
5.	8	1	6	2	7	0	4	3	5	9
	4	5	4	4	4	3	7	3	4	3
6.	9	3	0	7	2	6	1	4	8	5
	4	5	4	5	5	5	6	5	7	5
7.	5	6	2	7	1	4	9	0	8	3
	8	6	6	7	8	6	5	7	5	6
8.	3	5	1	0	6	7	2	9	8	4
	7	6	7	8	7	6	7	6	6	9
9.	5	6	2	8	4	1	9	9	7	3
	7	8	8	9	8	9	9	7	9	8
10.	6	1	9	3	8	2	0	7	5	9
	9	4	8	9	8	9	9	8	9	8

DRILL CHART IN RAPID ADDITION

Place the edge of your paper under the first row of examples and add rapidly, writing only the results. Then fold the answers under, do the next row, and so on:

1.	7	8	9	8	7	9	8	9	7	8
	6	9	6	8	8	7	7	8	9	6
2.	6	9	6	6	5	5	5	5	9	6
	8	9	7	9	8	6	7	9	4	6
3.	5	7	6	5	9	8	8	5	9	4
	9	5	2	6	3	4	1	9	7	5
	3	7	9	8	5	1	7	6	9	7
4.	6	2	4	5	1	9	8	7	3	6
	6	3	5	7	4	4	3	2	4	9
	1	6	1	6	2	3	7	4	2	8
5.	1	3	5	9	6	0	8	9	7	8
	3	6	2	2	9	8	4	3	3	7
	4	9	7	3	4	7	9	4	5	4
6.	7	7	9	8	5	2	6	3	5	2
	6	4	5	9	6	3	3	9	2	8
	1	6	3	4	7	9	5	8	6	9
7.	8	3	5	9	6	9	5	8	7	9
	3	9	4	2	2	3	9	3	8	0
	5	7	0	9	3	6	1	9	2	2

DRILL CHART IN RAPID ADDITION

Placing your paper as suggested on page 177, write the results of these additions as rapidly as you can, and then check each one by adding in the opposite direction:

1.	122	247	372	198	617	940
	340	326	421	657	249	582
	268	129	506	423	583	317

2.	963	201	269	436	487	429
	89	485	437	67	289	450
	528	76	180	270	83	478
	147	967	48	855	248	38

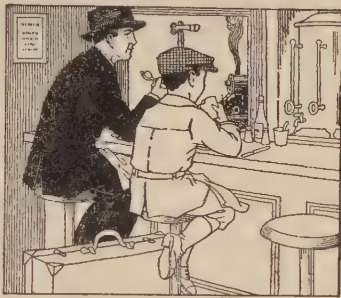
3.	902	785	268	307	689	543
	497	184	962	30	734	278
	973	38	564	752	47	106
	965	382	67	879	208	30

4.	914	106	277	125	742	609
	147	752	347	90	382	752
	583	99	967	235	86	328
	627	384	6	965	972	34

5.	142	279	938	968	304	478
	629	886	870	579	478	569
	438	157	226	487	892	342
	16	197	3	18	29	164
	740	403	514	326	698	873

PROBLEMS IN ADDITION

1. Mr. Brown and Ben had to take an early train to go to the state fair. They ate breakfast at the station, ordering a baked apple, 25¢; grapefruit, 30¢; omelette, 35¢; ham and eggs, 60¢; wheat cakes, 20¢; coffee, 10¢; cocoa, 10¢. How much was the bill?



2. At the fair, Mr. Brown bought a washing-machine for \$125.50, a radio set for \$39.75, a porch hammock for \$11.75, a bicycle for Ben costing \$37.50, and a cream separator for \$113.35. How much did he spend?

3. Last year our school-bank deposits were as follows: September, \$28.25; October, \$39.75; November, \$43.69; December, \$23.46; January, \$45.76; February, \$34.62; March, \$39.41; April, \$32.60; May, \$22.61. What was the total?

4. A dealer bought six car loads of coal weighing 102,607 lb., 99,342 lb., 98,746 lb., 101,609 lb., 103,429 lb., and 101,027 lb. Find the total number of pounds bought.

5. During one week the sales in a store were as follows: Monday, \$196.29; Tuesday, \$236.42; Wednesday, \$241.65; Thursday, \$255.75; Friday, \$262.81; and Saturday, \$309.28. Find the total sales for the week.

6. At a sale a dealer sold six overcoats at the following prices: \$18.50, \$24.75, \$36.50, \$49.95, \$59.50, and \$69.75. How much did he receive for all the coats?

DRILL CHART IN ADDING MONEY

Placing your paper as suggested on page 177, write the results of these additions as rapidly as you can, and then check each one by adding in the opposite direction:

1.	\$2.97	\$3.66	\$4.86	\$5.39	\$12.82
	3.42	.75	2.97	6.78	3.96
	6.08	2.68	3.42	.96	15.00
	9.25	3.47	7.88	3.07	19.29
2.	\$7.56	\$8.82	\$8.80	\$8.87	\$15.88
	3.49	3.41	2.75	9.26	16.72
	2.73	5.80	3.06	6.45	25.31
	5.28	9.62	4.22	5.32	40.25
	3.42	3.46	7.89	2.01	34.26
3.	\$8.72	\$9.45	\$3.97	\$7.76	\$27.92
	5.41	5.32	8.65	5.48	32.64
	1.23	3.24	5.34	8.32	58.76
	3.34	6.05	3.21	2.41	69.43
	5.65	5.78	5.09	5.75	80.72
	7.89	9.80	9.08	6.92	21.35
4.	\$1.28	\$8.77	\$5.40	\$6.50	\$34.68
	2.96	6.42	6.90	2.81	7.92
	3.48	9.39	7.77	5.72	34.77
	9.30	5.45	6.45	3.46	18.92
	5.77	2.39	3.29	9.87	27.76
	6.62	1.07	4.76	8.09	45.75

ORAL DRILL CHART IN RAPID SUBTRACTION

State the results of these subtractions rapidly:

1.	1	5	1	6	8	10	19	12	10	12
	0	4	1	5	7	6	9	7	1	2
2.	3	7	0	5	4	10	17	10	11	10
	3	6	0	5	3	4	8	8	7	5
3.	3	5	6	3	2	20	16	14	11	11
	1	3	3	2	1	6	8	5	8	4
4.	4	6	7	9	4	20	12	10	12	10
	0	4	5	7	2	7	8	7	4	3
5.	7	8	5	7	5	18	10	15	13	11
	3	1	2	4	0	9	9	7	7	2
6.	6	9	6	8	8	17	14	15	10	11
	2	6	1	5	6	9	8	6	2	6
7.	4	8	9	5	7	16	11	14	11	10
	1	2	4	1	7	9	9	7	5	4
8.	8	9	9	7	6	15	20	12	13	11
	3	5	3	0	0	9	8	6	4	3
9.	9	9	8	9	7	14	12	14	12	12
	8	1	8	2	2	9	9	6	3	5
10.	9	9	7	8	8	13	13	12	13	13
	9	0	1	0	4	9	8	8	5	6

DRILL CHART IN RAPID SUBTRACTION

Placing your paper as suggested on page 177, subtract, writing the results rapidly, and check each result by adding it to the number subtracted:

1.	247 125	673 251	529 318	643 401	796 685	825 302
2.	243 114	622 507	735 226	843 219	778 149	825 119
3.	826 132	548 356	702 131	820 340	971 280	517 256
4.	623 439	507 278	652 396	781 294	607 528	300 129
5.	742 698	807 348	912 637	803 436	912 377	814 698
6.	548 239	620 157	833 288	706 529	671 182	833 699
7.	980 69	700 77	802 160	513 96	800 69	525 197
8.	723 190	936 800	714 96	800 7	642 394	826 468
9.	628 194	877 222	628 99	547 123	625 389	333 99

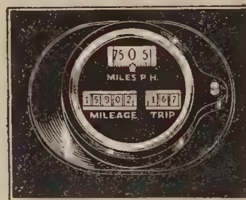
DRILL CHART IN SUBTRACTING MONEY

Placing your paper as suggested on page 177, write the results of the following subtractions rapidly, and check each result by adding it to the number subtracted:

1.	$8.70 2.60	$9.45 1.25	$7.35 5.05	$6.92 3.70	$25.48 10.25
2.	$8.62 4.34	$9.75 2.56	$6.30 4.15	$5.75 2.38	$62.32 41.28
3.	$7.23 4.60	$6.41 3.50	$9.78 4.91	$4.25 1.37	$33.48 21.62
4.	$9.36 7.48	$8.02 4.36	$7.00 .98	$8.25 1.38	$69.42 29.53
5.	$3.67 1.98	$4.60 2.85	$7.03 5.67	$5.01 2.62	$83.73 62.84
6.	$8.72 3.96	$5.81 2.96	$9.20 3.09	$8.73 7.83	$37.04 26.92
7.	$9.28 .96	$7.22 5.34	$9.20 7.32	$7.64 1.99	$44.43 39.78
8.	$8.13 4.66	$6.29 6.17	$5.33 3.53	$9.01 .68	$38.90 27.98
9.	$4.25 3.78	$6.07 2.39	$5.13 2.93	$6.48 3.96	$72.73 37.47

PROBLEMS IN SUBTRACTION

1. When Ben and Tom started on an automobile trip with their father, the speedometer registered 15,918.7 mi. When they arrived home, the speedometer registered 16,230.1 mi. How far did they go?



2. Our school team deposited in the bank, during the football season, receipts amounting to $920.31, and drew out $892.84 for expenses. How much was left?

3. We had a school bazaar to raise money to buy a printing press costing $275. After paying expenses, we cleared $189.34. How much more must we raise?

4. On Jan. 1 the gas meter in School No. 17 registered 5,642,000 cu. ft. On Feb. 1 it registered 5,753,000 cu. ft. How many cubic feet were used in January?

5. The water meter registered 1,653,587 cu. ft. on Jan. 1. On Mar. 1 it registered 2,502,431 cu. ft. How many cubic feet of water were used from Jan. 1 to Mar. 1?

6. We wish to buy a curtain costing $421.75 for our school auditorium. We already have $298.87 and plan to give a pageant to raise the rest. How much do we need?

7. In 1790 the population of the United States was 3,929,214. In 1920 it was 105,710,620. How many more people were there in the country in 1920?

8. The total area of the farms in the United States in 1900 was 623,218,619 A. In 1920 it was 955,883,715 A. How much greater was the acreage in 1920?

ORAL DRILL CHART IN RAPID MULTIPLICATION

State the results of these multiplications rapidly:

1.	5 7	6 8	2 8	8 9	4 8	1 9	9 9	9 7	7 9	3 8
2.	3 0	5 2	7 1	2 2	8 2	4 1	0 0	6 2	1 0	9 1
3.	8 1	7 2	9 2	5 0	2 1	3 2	1 1	4 2	0 1	6 1
4.	6 9	1 4	9 8	3 9	8 8	2 9	0 9	7 8	5 9	9 8
5.	6 0	4 4	5 3	0 2	1 3	3 4	2 3	8 0	7 3	0 6
6.	3 7	5 6	1 7	0 8	6 7	2 7	7 6	9 6	8 6	4 9
7.	1 5	8 4	6 4	2 4	7 4	0 3	4 7	3 3	5 4	9 3
8.	5 8	2 6	6 6	7 7	1 8	4 6	9 5	0 7	8 5	3 6
9.	3 5	9 4	0 4	7 5	2 5	6 5	1 6	4 5	8 7	5 5
10.	7 0	0 5	9 0	6 3	3 1	4 3	1 2	8 3	2 0	5 1

DRILL CHART IN RAPID MULTIPLICATION

Placing your paper as suggested on page 177, write the results of these multiplications as rapidly as you can, seeing how long it takes you to do them all:

1.	22	27	33	38	47	41	46	67
	2	2	3	3	3	4	4	4
2.	31	39	40	46	57	21	38	47
	5	5	6	6	6	5	5	5
3.	50	56	81	89	97	91	64	98
	6	6	7	7	7	8	8	8
4.	20	21	26	48	54	87	73	96
	9	9	9	9	9	9	9	9
5.	60	68	67	59	66	73	82	97
	8	8	8	8	8	8	8	8
6.	80	88	79	83	82	54	96	93
	6	6	6	6	7	7	7	7
7.	30	50	70	30	40	60	76	38
	8	8	9	7	5	4	9	7
8.	43	51	71	35	48	42	67	48
	7	8	9	7	5	7	9	8
9.	36	57	75	39	58	68	87	58
	9	8	9	7	5	3	6	9

DRILL CHART IN MULTIPLYING MONEY

Perform the following multiplications rapidly:

1.	$4.17	$9.81	$4.73	$0.98	$17.26
	6	2	6	10	13
2.	$5.31	$7.64	$6.74	$7.05	$19.39
	7	3	7	20	15
3.	$8.02	$5.75	$9.29	$37.07	$42.17
	9	4	5	7	11
4.	$7.43	$6.42	$3.02	$49.71	$76.92
	5	5	9	9	23
5.	$6.38	$7.07	$6.00	$39.69	$88.72
	4	6	6	6	39
6.	$2.93	$8.82	$7.32	$48.00	$49.63
	8	7	3	4	82
7.	$5.30	$9.24	$8.08	$52.09	$79.78
	3	8	8	5	69
8.	$6.00	$8.07	$9.39	$98.73	$98.79
	8	9	4	2	89
9.	$7.00	$7.35	$8.60	$47.80	$78.60
	9	9	8	5	32
10.	$6.83	$6.49	$5.22	$39.95	$86.22
	7	6	7	9	76

PROBLEMS IN MULTIPLICATION

1. The cashier at our cafeteria made this table of the day's receipts. Fill in the columns and find both totals:

Paper Money			Coins		
0 Twenties			73 Halves		
2 Tens			141 Quarters		
3 Fives			367 Dimes		
7 Twos			1242 Nickels		
36 Ones			1769 Pennies		
Total			Total		

2. In Ex. 1, what was the total amount received?

3. We used 17,000 cu. ft. of gas last month at $1.20 per 1000 cu. ft. How much was the gas bill?

4. Ben took 39 doz. eggs to the store and received 47¢ a dozen for them. How much money did he receive?

5. Mr. Brown sold 936 bu. of tomatoes to the canning factory and was paid at the rate of 43¢ per bushel. How much did he receive?

Find the cost of the following purchases:

6. 37 blankets at $5.75 each.

7. 378 electric-light bulbs at 49¢ each.

8. 29 cases of tomatoes at $3.60 per case.

9. 93 qt. of milk at 12¢ a quart.

10. 376 gal. of gasoline at 23¢ per gallon.

ORAL DRILL CHART IN RAPID DIVISION

State the results of these divisions rapidly:

1.	$2\overline{)4}$	$5\overline{)5}$	$7\overline{)14}$	$6\overline{)12}$	$5\overline{)10}$	$7\overline{)35}$
2.	$7\overline{)0}$	$3\overline{)3}$	$7\overline{)28}$	$4\overline{)16}$	$9\overline{)18}$	$4\overline{)20}$
3.	$8\overline{)8}$	$4\overline{)4}$	$8\overline{)16}$	$9\overline{)36}$	$5\overline{)35}$	$5\overline{)15}$
4.	$3\overline{)6}$	$9\overline{)63}$	$6\overline{)18}$	$9\overline{)27}$	$4\overline{)12}$	$2\overline{)10}$
5.	$4\overline{)8}$	$8\overline{)72}$	$7\overline{)21}$	$4\overline{)24}$	$7\overline{)42}$	$8\overline{)48}$
6.	$6\overline{)6}$	$7\overline{)63}$	$8\overline{)32}$	$6\overline{)24}$	$2\overline{)12}$	$3\overline{)12}$
7.	$3\overline{)0}$	$5\overline{)0}$	$8\overline{)24}$	$5\overline{)20}$	$7\overline{)49}$	$2\overline{)14}$
8.	$9\overline{)9}$	$9\overline{)72}$	$6\overline{)30}$	$4\overline{)28}$	$3\overline{)15}$	$4\overline{)32}$
9.	$2\overline{)0}$	$6\overline{)54}$	$4\overline{)36}$	$6\overline{)36}$	$2\overline{)16}$	$3\overline{)18}$
10.	$1\overline{)0}$	$6\overline{)0}$	$8\overline{)40}$	$4\overline{)40}$	$7\overline{)56}$	$5\overline{)25}$
11.	$3\overline{)9}$	$9\overline{)54}$	$6\overline{)42}$	$7\overline{)77}$	$3\overline{)21}$	$2\overline{)18}$
12.	$4\overline{)0}$	$8\overline{)0}$	$9\overline{)45}$	$5\overline{)30}$	$8\overline{)56}$	$6\overline{)54}$
13.	$7\overline{)7}$	$8\overline{)56}$	$8\overline{)64}$	$6\overline{)48}$	$2\overline{)20}$	$3\overline{)24}$
14.	$2\overline{)8}$	$4\overline{)44}$	$5\overline{)35}$	$9\overline{)54}$	$3\overline{)27}$	$7\overline{)70}$
15.	$2\overline{)6}$	$9\overline{)18}$	$9\overline{)63}$	$9\overline{)81}$	$5\overline{)40}$	$8\overline{)80}$

DRILL CHART ON THE DIVISION TABLE

Copy and complete the following division tables:

1. $\frac{0}{1} = 0$, $\frac{1}{1} = 1$, $\frac{2}{1} = 2$, and so on to $\frac{10}{1} = 10$.
2. $\frac{0}{2} = 0$, $\frac{2}{2} = 1$, $\frac{4}{2} = 2$, and so on to $\frac{20}{2} = 10$.
3. $\frac{0}{3} = 0$, $\frac{3}{3} = 1$, $\frac{6}{3} = 2$, and so on to $\frac{30}{3} = 10$.
4. $\frac{0}{4} = 0$, $\frac{4}{4} = 1$, $\frac{8}{4} = 2$, and so on to $\frac{40}{4} = 10$.
5. $\frac{0}{5} = 0$, $\frac{5}{5} = 1$, $\frac{10}{5} = 2$, and so on to $\frac{50}{5} = 10$.

Continue the above tables from

6. $\frac{0}{6} = 0$ to $\frac{60}{6} = 10$.
7. $\frac{0}{7} = 0$ to $\frac{70}{7} = 10$.
8. $\frac{0}{8} = 0$ to $\frac{80}{8} = 10$.
9. $\frac{0}{9} = 0$ to $\frac{90}{9} = 10$.

Copy and complete the following statements:

10. $81 \div 9 =$	20. $56 \div 7 =$	30. $120 \div 10 =$
11. $32 \div 8 =$	21. $36 \div 9 =$	31. $120 \div 12 =$
12. $72 \div 9 =$	22. $42 \div 6 =$	32. $144 \div 12 =$
13. $49 \div 7 =$	23. $48 \div 8 =$	33. $132 \div 11 =$
14. $48 \div 6 =$	24. $42 \div 7 =$	34. $132 \div 12 =$
15. $54 \div 9 =$	25. $56 \div 8 =$	35. $121 \div 11 =$
16. $24 \div 8 =$	26. $36 \div 6 =$	36. $108 \div 12 =$
17. $45 \div 9 =$	27. $72 \div 8 =$	37. $108 \div 9 =$
18. $40 \div 8 =$	28. $27 \div 9 =$	38. $108 \div 27 =$
19. $54 \div 6 =$	29. $63 \div 7 =$	39. $108 \div 36 =$

ORAL DRILL CHART IN RAPID DIVISION

State the results rapidly, including the remainders:

1. $2\overline{)3}$	16. $6\overline{)22}$	31. $8\overline{)62}$	46. $9\overline{)43}$	61. $9\overline{)51}$
2. $2\overline{)5}$	17. $9\overline{)33}$	32. $8\overline{)61}$	47. $9\overline{)35}$	62. $9\overline{)26}$
3. $2\overline{)7}$	18. $9\overline{)31}$	33. $8\overline{)63}$	48. $9\overline{)40}$	63. $9\overline{)14}$
4. $2\overline{)9}$	19. $7\overline{)51}$	34. $9\overline{)70}$	49. $7\overline{)40}$	64. $6\overline{)41}$
5. $2\overline{)1}$	20. $7\overline{)54}$	35. $4\overline{)10}$	50. $4\overline{)31}$	65. $7\overline{)34}$
6. $3\overline{)4}$	21. $7\overline{)61}$	36. $9\overline{)16}$	51. $9\overline{)24}$	66. $9\overline{)20}$
7. $3\overline{)5}$	22. $7\overline{)68}$	37. $4\overline{)11}$	52. $6\overline{)55}$	67. $8\overline{)55}$
8. $3\overline{)8}$	23. $9\overline{)40}$	38. $7\overline{)11}$	53. $8\overline{)11}$	68. $9\overline{)60}$
9. $3\overline{)2}$	24. $9\overline{)60}$	39. $8\overline{)13}$	54. $8\overline{)60}$	69. $7\overline{)13}$
10. $5\overline{)2}$	25. $9\overline{)62}$	40. $8\overline{)52}$	55. $8\overline{)31}$	70. $9\overline{)32}$
11. $5\overline{)1}$	26. $9\overline{)22}$	41. $6\overline{)11}$	56. $9\overline{)13}$	71. $9\overline{)10}$
12. $5\overline{)4}$	27. $9\overline{)44}$	42. $9\overline{)11}$	57. $9\overline{)30}$	72. $7\overline{)12}$
13. $6\overline{)7}$	28. $6\overline{)50}$	43. $9\overline{)42}$	58. $8\overline{)53}$	73. $9\overline{)34}$
14. $6\overline{)5}$	29. $7\overline{)32}$	44. $9\overline{)50}$	59. $9\overline{)51}$	74. $8\overline{)15}$
15. $6\overline{)1}$	30. $9\overline{)64}$	45. $9\overline{)53}$	60. $9\overline{)71}$	75. $8\overline{)21}$

SPEED TEST CHART IN DIVISION

Perform these divisions on paper, writing the number of minutes it takes for each column:

1. $7\overline{)4910}$	18. $6\overline{)5407}$	35. $12\overline{)1452}$
2. $6\overline{)3624}$	19. $7\overline{)5609}$	36. $23\overline{)3496}$
3. $5\overline{)7002}$	20. $8\overline{)6417}$	37. $23\overline{)4830}$
4. $8\overline{)4807}$	21. $15\overline{)165}$	38. $23\overline{)4853}$
5. $9\overline{)8102}$	22. $15\overline{)1650}$	39. $27\overline{)2970}$
6. $3\overline{)3901}$	23. $21\overline{)2310}$	40. $27\overline{)2997}$
7. $2\overline{)4801}$	24. $21\overline{)2331}$	41. $42\overline{)6048}$
8. $3\overline{)6120}$	25. $31\overline{)3441}$	42. $42\overline{)6468}$
9. $4\overline{)4803}$	26. $41\overline{)4551}$	43. $42\overline{)6510}$
10. $5\overline{)7511}$	27. $19\overline{)2090}$	44. $47\overline{)3807}$
11. $6\overline{)6636}$	28. $18\overline{)1998}$	45. $53\overline{)3763}$
12. $7\overline{)5614}$	29. $17\overline{)3570}$	46. $55\overline{)3355}$
13. $8\overline{)4848}$	30. $17\overline{)3587}$	47. $55\overline{)3850}$
14. $9\overline{)8118}$	31. $33\overline{)6996}$	48. $57\overline{)4047}$
15. $3\overline{)3618}$	32. $33\overline{)9900}$	49. $82\overline{)6642}$
16. $4\overline{)3216}$	33. $33\overline{)9999}$	50. $83\overline{)4233}$
17. $5\overline{)4551}$	34. $12\overline{)1440}$	51. $92\overline{)2576}$

PROBLEMS IN DIVISION

1. It is about 5302 mi. from New York to San Francisco through the Panama Canal. At an average speed of 21 mi. per hour, in how many days will a steamer make the trip?

2. The distance from New York to San Francisco by the route around South America is about 13,244 mi. At an average speed of 21 mi. per hour, how many days will it take a steamer to make the trip?

3. In one week 50 vessels passed through the Panama Canal, and paid a total of $211,150 for tolls. What was the average toll per vessel?

4. If it costs $104,760 to run a village school system for 180 da., what is the average cost per day?

5. If the coal used in heating our school for a period of 120 da. costs $81.60, what is the cost per day?

6. Ben's father found that he used 330 gal. of gasoline to drive his car a total of 5280 mi. This was an average of how many miles per gallon?

7. A man buys $1729.44 worth of household furniture. If he pays for it in 18 equal monthly installments, what is the amount of each payment?

8. The sun is about 93,000,000 mi. from the earth. If you could travel by airplane from the earth to the sun at the rate of 100 mi. an hour, how many days would it take you to get there? This is about how many years?

9. In a recent year it cost a large city about $3,049,000 to educate the 27,000 children in the elementary schools. About how much did it cost to educate each pupil?

PROBLEMS FOR GIRLS

1. If you wish to buy material to curtain two windows and need 4 yd. for each window, how much will the material cost at 90¢ a yard?

In solving this problem, think to yourself: "I am given (1) the number of windows, and (2) the number of yards for each window. I can therefore find the total number of yards. I am also given (3) the price per yard, and so can find the total cost. That is, there are two steps: (1) to find the total number of yards, and (2) to find the cost."

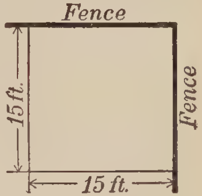
2. If you wish to buy material to curtain four windows and need 5 yd. for each window, how much will the material cost at 80¢ a yard?

3. Suppose that you wish to buy material to curtain two windows, and that each window is 5 ft. high and requires two widths of material. If it is necessary to allow 9 in. on each strip for hemming, how much will the material cost at 90¢ a yard?

In solving this problem, think to yourself: "I am given (1) the number of windows, (2) the height of each, (3) the number of strips to a window, (4) that each strip requires 5 ft. 9 in. of material, and (5) the price per yard. Hence by taking $2 \times 2 \times 5$ ft. 9 in. I can find the number of yards. I can multiply 5 ft. 9 in. by 2×2, or 4, by simply writing 4×5 ft. $= 20$ ft. $= 6\frac{2}{3}$ yd., and 4×9 in. $= 36$ in. $= 1$ yd. I therefore need $6\frac{2}{3}$ yd. $+ 1$ yd., or $7\frac{2}{3}$ yd. Then, since I know the price per yard, I can find the total cost by multiplying the price per yard by the number of yards; that is, $7\frac{2}{3} \times 90$¢ will give me the answer."

PROBLEMS FOR BOYS

1. Ben and Tom built a new pen for their rabbits. They built it in a corner of the yard close to a tight-board fence, and so had to build only two sides, each 15 ft. long. The boys used small-meshed chicken wire costing 6¢ a running foot. How much did the wire cost?



Think to yourself: "I am given (1) the number of feet for each side, (2) the number of sides to be built, and (3) the cost per foot. There are therefore two steps: (1) to find the total number of feet, and (2) to find the cost."

2. Walter and Sam also built a rabbit pen, but had no fence against which to build. They therefore had to build four sides, each of which they made 10 ft. long. Their wire was wider than that used in Ex. 1 and cost 8¢ a running foot. How much did the wire for this pen cost?

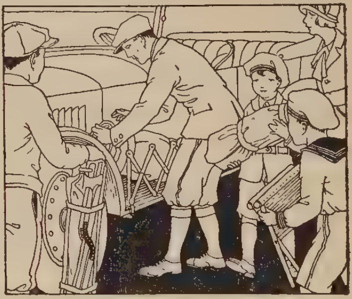
3. The rabbits got out of the pens by digging under the wire. To stop this the boys had to put a strip of chicken wire down into the ground all round the pens. This wire was not so wide and cost only 4¢ a foot. How much did this wire cost for the pen belonging to Walter and Sam?

4. At 4¢ a foot, what did it cost Ben and Tom for wire to put into the ground on all four sides of their pen?

5. The cats and dogs jumped over the top of the wire and tried to catch the rabbits. To cover their pen Ben and Tom used five strips of wire, each 15 ft. long, and Walter and Sam used four strips, each 10 ft. long. At 11¢ a foot, how much did it cost to cover each pen?

PROBLEMS ABOUT A CAMPING TRIP

1. The Brown family is getting ready for an automobile camping trip. They buy the following articles: a tent, \$11.25; 5 folding cots at \$2.98 each; a cook-stove, \$4.95; camp dishes, \$11.75; a folding table, \$4.75; 5 camp stools at 98¢ each; and 5 blankets at \$5.95 each. How much do all these cost?



2. For camp clothing Mr. Brown spends \$5.75, Mrs. Brown spends \$6.30, and they spend \$2.95 each for Ben, Tom, and Tony. How much does the clothing cost?

3. Their car averages 15 mi. to 1 gal. of gasoline and uses 1 qt. of oil every 100 mi. At 25¢ a gallon for gasoline and 30¢ a quart for the oil, how much will the gasoline and oil cost if they travel 1500 mi.?

4. Before they start on the trip they also buy a new battery for the car at \$34.50, 3 new tires at \$29.50 each, and 3 new inner tubes at \$4.25 each. How much do all these articles cost?

5. All three boys need bathing suits, which cost \$2.75 each. Ben and Tom need sweaters, which cost \$3.25 each, and Tony needs a pair of water wings, which cost 59¢. Mr. Brown plans to buy a new fishing pole for \$5.95 and a reel for \$2.45. Mrs. Brown needs a raincoat, which costs \$14.75. How much will all these articles cost?

Invoice. An *invoice* is a bill which is sent by a wholesale business house to a retail dealer at the time that goods are shipped. The following model shows a simple invoice:

SCOTT AND FIELD

Wholesale Grocers

Sold to

H. J. Smith
64 Main St.
Anoka, Minn.

ST. PAUL, MINN., Jan. 10, *1928*

10 cases tomatoes	@	3.50	35	00		
6 boxes soap	@	7.80	46	80		
500 lb. sugar	@	7¢	35	00		
					116	80

MAKING INVOICES

Make invoices for the following orders:

1. 2 Wilton rugs @ \$87.50, 15 yd. linoleum @ \$1.75, 12 yd. oil cloth @ 85¢, 6 dining-room chairs @ \$8.75.

2. 3 bed-room sets @ \$390.50, 6 dining tables at \$37.50, 3 doz. dining-room chairs @ \$96.50 per dozen.

3. 5 player pianos @ \$875.50, 25 mandolins @ \$5.75, 20 clarionets @ \$17.25, 30 saxophones @ \$10.25.

4. 15 washing machines @ \$114.95, 8 clothes hampers @ \$6.75, 6 doz. mop-wringers @ \$27.50 per dozen, 16 vacuum cleaners @ \$45.50.

5. 15 radio sets @ \$23.50, 25 sets @ \$39.75, 27 sets @ \$59.00, 5 sets @ \$119.95, 35 loud speakers @ \$20.75.

6. Make up three invoice problems in which you use prices found, if possible, from stores in your city or town.

Using Large Numbers. The number shown below is read "one hundred forty-seven billion three hundred seven million four hundred twenty-seven thousand two hundred eighty."

$$\overbrace{147}^{\text{Billions}},\overbrace{307}^{\text{Millions}},\overbrace{427}^{\text{Thousands}},\overbrace{280}^{\text{Units}}$$

Numbers as large as this are used chiefly in speaking of sums borrowed by nations. Numbers in millions are often used in speaking of the population of cities, states, and countries, or in speaking of the money needed to carry on large industries or in paying the expenses of a city or state. The exercises below show some of the ways in which large numbers are used. These figures are not exactly correct because the populations change from year to year, and even from day to day.

READING AND WRITING NUMBERS

Read aloud the following numbers which represent the populations of the countries named:

1. United States, 105,711,000.
2. Germany, 59,858,000.
3. England, 35,678,000.
4. France, 39,403,000.
5. China, 302,110,000.
6. India, 247,140,000.

Copy the following, writing the numbers in words:

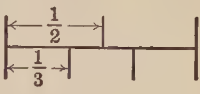
7. The population of the entire British Empire in a recent year was 441,595,965.

8. The public debt of the United States before the World War was $1,908,635,000, and during the war it rose to $26,596,701,648.

II. FRACTIONS

REVIEW OF EASY WORK

1. Here is a line 1 in. long. It is divided into halves and also into thirds. We see that $\frac{1}{2}$ is greater than $\frac{1}{3}$. Draw a line 3 in. long, divide it into thirds and also into fourths, and find which is greater, $\frac{1}{3}$ or $\frac{1}{4}$. Write your answer.



2. From Ex. 1 find which is greater, $\frac{2}{3}$ or $\frac{3}{4}$.

3. As in Ex. 1, show which is greater, $\frac{2}{3}$ or $\frac{3}{5}$.

4. Draw a line and divide it to show that $\frac{1}{2} = \frac{2}{4} = \frac{4}{8}$.

Draw lines and divide them to show that

5. $\frac{3}{4} = \frac{6}{8}$. **7.** $\frac{2}{5} = \frac{4}{10}$. **9.** $\frac{1}{6} = \frac{2}{12}$. **11.** $\frac{1}{3} = \frac{2}{6} = \frac{4}{12}$.

6. $\frac{1}{5} = \frac{2}{10}$. **8.** $\frac{3}{5} = \frac{6}{10}$. **10.** $\frac{5}{6} = \frac{10}{12}$. **12.** $\frac{1}{4} = \frac{2}{8} = \frac{4}{16}$.

Copy and complete the following statements:

13. $\frac{3}{4} + \frac{1}{4} =$ **15.** $\frac{3}{4} \times \frac{1}{4} =$ **17.** $\frac{3}{4} \div \frac{1}{4} =$

14. $\frac{3}{4} - \frac{1}{4} =$ **16.** $\frac{1}{4} \times \frac{3}{4} =$ **18.** $\frac{1}{4} \div \frac{3}{4} =$

Count forward to and then backward from

19. 3 by $\frac{1}{4}$, saying $\frac{1}{4}$, $\frac{2}{4}$, $\frac{3}{4}$, $\frac{4}{4}$, $\frac{5}{4}$, and so on. Then count again, saying $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$, and so on.

20. 2 by $\frac{1}{8}$, saying $\frac{1}{8}$, $\frac{2}{8}$, $\frac{3}{8}$, $\frac{4}{8}$, $\frac{5}{8}$, and so on. Then count again, saying $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, and so on.

21. 3 by $\frac{1}{3}$, saying $\frac{1}{3}$, $\frac{2}{3}$, 1, and so on.

22. 2 by $\frac{1}{6}$, saying $\frac{1}{6}$, $\frac{1}{3}$, $\frac{1}{2}$, $\frac{2}{3}$, and so on.

23. 1 by $\frac{1}{12}$, saying $\frac{1}{12}$, $\frac{1}{6}$, $\frac{1}{4}$, $\frac{1}{3}$, $\frac{5}{12}$, and so on.

DRILL CHART IN ADDING FRACTIONS

Numbers 1 to 20, oral

State the results of the following additions:

1. $\frac{1}{2}+\frac{1}{2}$.	**6.** $\frac{3}{8}+\frac{5}{8}$.	**11.** $\frac{2}{4}+\frac{1}{4}$.	**16.** $\frac{1}{2}+\frac{3}{4}$.
2. $\frac{1}{4}+\frac{3}{4}$.	**7.** $\frac{5}{8}+\frac{3}{8}$.	**12.** $\frac{1}{2}+\frac{1}{4}$.	**17.** $\frac{1}{2}+\frac{5}{8}$.
3. $\frac{3}{4}+\frac{1}{4}$.	**8.** $\frac{1}{5}+\frac{4}{5}$.	**13.** $\frac{4}{8}+\frac{3}{8}$.	**18.** $\frac{3}{4}+\frac{3}{8}$.
4. $\frac{1}{8}+\frac{7}{8}$.	**9.** $\frac{2}{5}+\frac{3}{5}$.	**14.** $\frac{1}{2}+\frac{3}{8}$.	**19.** $\frac{3}{4}+\frac{5}{8}$.
5. $\frac{7}{8}+\frac{1}{8}$.	**10.** $\frac{1}{6}+\frac{5}{6}$.	**15.** $\frac{1}{4}+\frac{1}{8}$.	**20.** $\frac{3}{4}+\frac{7}{8}$.

Write the following fractions as indicated:

21. $\frac{3}{4}$ as twelfths.	**24.** $\frac{5}{6}$ as twelfths.
22. $\frac{2}{3}$ as twelfths.	**25.** $\frac{1}{2}$ as sixteenths.
23. $\frac{5}{8}$ as sixteenths.	**26.** $\frac{3}{5}$ as twentieths.

Find the results of the following additions:

27. $\frac{3}{8}+\frac{1}{2}$.	**30.** $\frac{1}{2}+\frac{1}{4}+\frac{1}{3}$.	**33.** $\frac{1}{3}+\frac{1}{3}+\frac{1}{5}$.
28. $\frac{1}{2}+\frac{7}{8}$.	**31.** $\frac{1}{2}+\frac{3}{4}+\frac{1}{3}$.	**34.** $\frac{1}{3}+\frac{2}{3}+\frac{2}{5}$.
29. $\frac{1}{2}+\frac{1}{3}$.	**32.** $\frac{1}{2}+\frac{3}{4}+\frac{2}{3}$.	**35.** $\frac{1}{3}+\frac{1}{4}+\frac{1}{5}$.

36. Which is the larger, $2\frac{3}{4}+5\frac{7}{8}$ or $3\frac{7}{8}+4\frac{3}{4}$?

Perform the following additions:

37. $1\frac{1}{2}+2\frac{3}{4}$.	**41.** $3\frac{1}{3}+2\frac{1}{2}$.	**45.** $3\frac{5}{6}+3\frac{1}{2}$.
38. $3\frac{3}{4}+2\frac{3}{4}$.	**42.** $3\frac{2}{3}+2\frac{1}{2}$.	**46.** $2\frac{5}{6}+5\frac{1}{4}$.
39. $2\frac{5}{8}+3\frac{1}{4}$.	**43.** $4\frac{1}{3}+3\frac{1}{4}$.	**47.** $5\frac{5}{6}+3\frac{3}{4}$.
40. $3\frac{7}{8}+2\frac{1}{4}$.	**44.** $4\frac{2}{3}+3\frac{3}{4}$.	**48.** $2\frac{1}{6}+1\frac{1}{8}$.

DRILL CHART IN SUBTRACTING FRACTIONS

Numbers 1 to 20, oral

State the results of the following subtractions:

1. $\frac{1}{2} - \frac{1}{4}$.
2. $\frac{3}{4} - \frac{1}{4}$.
3. $\frac{3}{4} - \frac{1}{2}$.
4. $\frac{7}{8} - \frac{1}{8}$.
5. $\frac{7}{8} - \frac{5}{8}$.
6. $\frac{5}{8} - \frac{3}{8}$.
7. $\frac{7}{8} - \frac{3}{8}$.
8. $\frac{4}{5} - \frac{1}{5}$.
9. $\frac{4}{5} - \frac{2}{5}$.
10. $\frac{3}{5} - \frac{2}{5}$.
11. $\frac{3}{8} - \frac{1}{8}$.
12. $\frac{1}{4} - \frac{1}{8}$.
13. $\frac{4}{8} - \frac{1}{8}$.
14. $\frac{1}{2} - \frac{1}{8}$.
15. $\frac{7}{8} - \frac{2}{8}$.
16. $\frac{5}{6} - \frac{1}{6}$.
17. $\frac{5}{6} - \frac{2}{3}$.
18. $\frac{7}{8} - \frac{6}{8}$.
19. $\frac{7}{8} - \frac{3}{4}$.
20. $\frac{7}{8} - \frac{1}{4}$.

Write the following fractions as indicated:

21. $\frac{3}{4}$ as eighths.
22. $\frac{3}{4}$ as sixteenths.
23. $\frac{5}{6}$ as 24ths.
24. $\frac{3}{8}$ as sixteenths.

Subtract as indicated:

25. $\frac{3}{8} - \frac{1}{4}$.
26. $\frac{3}{4} - \frac{3}{8}$.
27. $\frac{5}{8} - \frac{1}{2}$.
28. $\frac{7}{8} - \frac{1}{2}$.
29. $1 - \frac{3}{8}$.
30. $\frac{5}{6} - \frac{1}{2}$.
31. $\frac{1}{2} - \frac{1}{6}$.
32. $\frac{1}{4} - \frac{1}{6}$.
33. $\frac{3}{4} - \frac{1}{6}$.
34. $\frac{5}{6} - \frac{3}{4}$.
35. $\frac{1}{2} - \frac{5}{12}$.
36. $\frac{1}{2} - \frac{1}{16}$.
37. $\frac{1}{2} - \frac{5}{16}$.
38. $\frac{9}{16} - \frac{1}{2}$.
39. $\frac{9}{16} - \frac{1}{4}$.
40. Subtract $3\frac{7}{8}$ from $11\frac{1}{4}$ and check your result.

Perform the following additions and subtractions:

41. $2\frac{7}{8} + 1\frac{3}{4} - \frac{5}{8}$.
42. $3\frac{5}{8} + 2\frac{1}{2} - 1\frac{3}{4}$.
43. $6\frac{1}{2} + 3\frac{5}{8} - 2\frac{1}{4}$.
44. $2\frac{3}{8} + 1\frac{1}{16} - 1\frac{3}{4}$.
45. $5\frac{2}{3} + 3\frac{1}{6} - 2\frac{1}{2}$.
46. $8\frac{7}{8} - 1\frac{1}{4} - 2\frac{1}{16}$.

PROBLEMS IN ADDITION AND SUBTRACTION

1. Before we try these problems let us review counting forward and backward by fractions. It is good fun and it will help us in problems with fractions. Count to 4 by $\frac{1}{2}$, beginning $\frac{1}{2}$, 1, $1\frac{1}{2}$, 2, and so on. Then count backward, beginning 4, $3\frac{1}{2}$, 3, $2\frac{1}{2}$, and so on.

As in Ex. 1, count forward to and backward from

2. 4 by $\frac{1}{4}$.

3. 4 by $\frac{1}{8}$.

4. 3 by $\frac{1}{16}$.

5. 3 by $\frac{1}{6}$.

6. 2 by $\frac{1}{12}$.

7. 2 by $\frac{1}{10}$.

8. A basket weighs $1\frac{3}{4}$ lb. When filled with cherries it weighs $29\frac{1}{4}$ lb. How much do the cherries weigh?

9. John needs a stick $34\frac{3}{8}$ in. long to hold up a window. A stick $36\frac{1}{2}$ in. long is how much too long?

10. Helen had a piece of ribbon $1\frac{1}{8}$ yd. long and used $\frac{5}{8}$ yd. of it. How much was left?

11. Ben dug $20\frac{1}{4}$ lb. of potatoes, and Tom dug $18\frac{1}{2}$ lb. How many pounds did they both dig?

12. Ben can jump over a rope $3\frac{3}{4}$ ft. above the ground, and Tom can jump over it when it is $3\frac{1}{3}$ ft. above the ground. How much higher can Ben jump than Tom?

13. The boys had a rope 40 ft. long. Ben cut off $8\frac{1}{2}$ ft., and Tom cut off $8\frac{1}{4}$ ft. How much rope was left?

14. Ben, Tom, and Tony ran in a relay race. Ben's time was $1\frac{2}{3}$ min., Tom's was $1\frac{1}{2}$ min., and Tony's was $1\frac{4}{5}$ min. How long did it take them to run the race?

15. State what must be added to each of these fractions to make it equal to $1\frac{1}{4}$: $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{12}$, $\frac{1}{16}$, $\frac{7}{8}$, $\frac{3}{4}$, $\frac{5}{8}$, $\frac{3}{16}$, $\frac{7}{16}$, $\frac{3}{8}$.

DRILL CHART IN MULTIPLYING FRACTIONS

Numbers 1 to 21, oral

State rapidly the results of these multiplications:

1. $\frac{1}{2} \times \frac{1}{2}$.	6. $\frac{1}{2} \times \frac{5}{8}$.	11. $\frac{1}{3} \times \frac{1}{8}$.	16. $\frac{1}{4} \times \frac{1}{6}$.
2. $\frac{1}{2} \times \frac{1}{4}$.	7. $\frac{1}{2} \times \frac{7}{8}$.	12. $\frac{1}{3} \times \frac{5}{8}$.	17. $\frac{1}{4} \times \frac{5}{6}$.
3. $\frac{1}{2} \times \frac{3}{4}$.	8. $\frac{1}{2} \times \frac{1}{3}$.	13. $\frac{1}{3} \times \frac{7}{8}$.	18. $\frac{1}{4} \times \frac{1}{8}$.
4. $\frac{1}{2} \times \frac{1}{8}$.	9. $\frac{1}{2} \times \frac{1}{6}$.	14. $\frac{2}{3} \times \frac{5}{8}$.	19. $\frac{3}{4} \times \frac{1}{8}$.
5. $\frac{1}{2} \times \frac{3}{8}$.	10. $\frac{1}{2} \times \frac{5}{6}$.	15. $\frac{2}{3} \times \frac{7}{8}$.	20. $\frac{3}{4} \times \frac{7}{8}$.

21. Which is the larger, $2 \times 1\frac{7}{8}$ or $1 \times 2\frac{7}{8}$?

Perform the following multiplications:

22. $\frac{1}{2} \times \frac{2}{3}$.	28. $\frac{1}{6} \times \frac{3}{8}$.	34. $\frac{2}{5} \times \frac{5}{16}$.
23. $\frac{1}{3} \times \frac{3}{4}$.	29. $\frac{5}{6} \times \frac{3}{8}$.	35. $\frac{4}{5} \times \frac{5}{16}$.
24. $\frac{2}{3} \times \frac{3}{4}$.	30. $\frac{4}{5} \times \frac{7}{8}$.	36. $\frac{1}{2} \times \frac{1}{12}$.
25. $\frac{1}{2} \times \frac{4}{5}$.	31. $\frac{1}{3} \times \frac{3}{16}$.	37. $\frac{1}{2} \times \frac{5}{12}$.
26. $\frac{1}{3} \times \frac{3}{8}$.	32. $\frac{2}{3} \times \frac{3}{16}$.	38. $\frac{6}{7} \times \frac{7}{12}$.
27. $\frac{2}{3} \times \frac{3}{8}$.	33. $\frac{1}{6} \times \frac{3}{16}$.	39. $\frac{3}{10} \times \frac{5}{12}$.

40. Multiply $2\frac{1}{2}$ by $3\frac{2}{3}$ and $3\frac{1}{2}$ by $2\frac{2}{3}$.

Perform the following multiplications:

41. $1\frac{1}{2} \times 1\frac{1}{2}$.	46. $4\frac{1}{3} \times 1\frac{1}{2}$.	51. $1\frac{1}{3} \times 2\frac{1}{6}$.
42. $1\frac{1}{2} \times 2\frac{1}{4}$.	47. $4\frac{2}{3} \times 1\frac{1}{2}$.	52. $1\frac{2}{3} \times 2\frac{1}{6}$.
43. $2\frac{1}{2} \times 2\frac{3}{4}$.	48. $4\frac{2}{3} \times 5\frac{1}{2}$.	53. $1\frac{2}{3} \times 2\frac{5}{6}$.
44. $3\frac{1}{4} \times 2\frac{1}{8}$.	49. $5\frac{1}{8} \times 5\frac{1}{8}$.	54. $1\frac{1}{3} \times 1\frac{1}{8}$.
45. $3\frac{3}{4} \times 2\frac{1}{8}$.	50. $5\frac{1}{8} \times 5\frac{3}{8}$.	55. $1\frac{2}{3} \times 2\frac{3}{8}$.

PROBLEMS IN MULTIPLICATION

1. If Ben can walk $\frac{2}{3}$ of the way to town in 1 hr., what part of the distance can he walk at this rate in $\frac{1}{2}$ hr.?

2. If you buy $\frac{3}{4}$ lb. of candy and give half of it to a friend, how much do you have left?

3. Our motor boat traveled at the rate of $8\frac{1}{2}$ mi. an hour for $3\frac{1}{4}$ hr. How far did it go?

4. How much will $4\frac{1}{2}$ lb. of sugar cost at $6\frac{2}{3}$¢ a pound?

5. If Tony can weed $3\frac{1}{2}$ rows of onions in 1 hr., how many rows can he weed in $3\frac{1}{2}$ hr.?

6. If Tom's steps measure $2\frac{1}{2}$ ft. each, and he takes $18\frac{1}{2}$ steps to cross the yard, how wide is the yard?

7. On an automobile trip we averaged $24\frac{1}{2}$ mi. an hour for $5\frac{3}{4}$ hr. How far did we go?

8. If our school cafeteria uses an average of $57\frac{1}{2}$ lb. of butter per week, how much will it use in $2\frac{2}{5}$ wk.?

9. How much do $1\frac{5}{12}$ doz. cups cost at $4.80 per dozen?

10. If the pupils in our room drink $131\frac{1}{4}$ qt. of milk a week, how much shall we use in $1\frac{3}{5}$ wk.?

11. The gasoline tank on Mr. Green's car holds $18\frac{1}{2}$ gal. When it is $\frac{3}{4}$ full, how much gasoline has he?

12. The gasoline tank on a truck holds $36\frac{3}{4}$ gal. If it is only $\frac{1}{4}$ full, how much will it take to fill it?

13. The radiator on Mr. Brown's truck has a capacity of $3\frac{3}{4}$ gal. To keep it from freezing in the winter he fills it $\frac{1}{3}$ full of denatured alcohol and $\frac{2}{3}$ full of water. How much alcohol does he use?

DRILL CHART IN DIVIDING FRACTIONS

Numbers 1 to 20, oral

State rapidly the results of the following divisions:

1. $\frac{1}{2} \div \frac{1}{2}$.	6. $1 \div \frac{1}{2}$.	11. $3 \div \frac{1}{3}$.	16. $\frac{1}{8} \div \frac{1}{8}$.
2. $\frac{1}{4} \div \frac{1}{4}$.	7. $1 \div \frac{1}{4}$.	12. $4 \div \frac{1}{4}$.	17. $\frac{3}{8} \div \frac{1}{8}$.
3. $\frac{3}{4} \div \frac{1}{4}$.	8. $1 \div \frac{1}{5}$.	13. $5 \div \frac{1}{5}$.	18. $\frac{1}{8} \div \frac{3}{8}$.
4. $\frac{1}{4} \div \frac{3}{4}$.	9. $2 \div \frac{1}{2}$.	14. $\frac{1}{3} \div 3$.	19. $\frac{5}{8} \div \frac{3}{8}$.
5. $\frac{3}{4} \div \frac{3}{4}$.	10. $2 \div \frac{1}{4}$.	15. $\frac{1}{4} \div 4$.	20. $\frac{5}{8} \div \frac{7}{8}$.

21. Divide $\frac{7}{8}$ by $\frac{1}{8}$ and $\frac{1}{8}$ by $\frac{7}{8}$.

Perform the following divisions:

22. $\frac{1}{2} \div \frac{1}{4}$.	27. $\frac{1}{8} \div \frac{1}{4}$.	32. $\frac{7}{8} \div \frac{3}{4}$.	37. $\frac{1}{2} \div \frac{2}{3}$.
23. $\frac{1}{4} \div \frac{1}{2}$.	28. $\frac{3}{8} \div \frac{1}{4}$.	33. $\frac{5}{8} \div \frac{3}{4}$.	38. $\frac{2}{3} \div \frac{1}{2}$.
24. $\frac{1}{2} \div \frac{3}{4}$.	29. $\frac{3}{8} \div \frac{3}{4}$.	34. $\frac{1}{4} \div \frac{5}{8}$.	39. $\frac{1}{3} \div \frac{1}{4}$.
25. $\frac{3}{4} \div \frac{1}{2}$.	30. $\frac{3}{4} \div \frac{3}{8}$.	35. $\frac{1}{3} \div \frac{1}{2}$.	40. $\frac{1}{8} \div \frac{5}{8}$.
26. $\frac{1}{4} \div \frac{1}{8}$.	31. $\frac{3}{4} \div \frac{7}{8}$.	36. $\frac{1}{2} \div \frac{1}{3}$.	41. $\frac{2}{3} \div \frac{7}{8}$.

42. How much greater is $2\frac{3}{4} \div 3\frac{2}{3}$ than $22\frac{1}{2} \div 30$?

Perform the following divisions:

43. $2\frac{1}{2} \div 1\frac{1}{4}$.	49. $3\frac{1}{8} \div \frac{7}{8}$.	55. $3\frac{2}{3} \div \frac{1}{8}$.
44. $3\frac{1}{2} \div 1\frac{3}{4}$.	50. $2\frac{7}{8} \div \frac{1}{3}$.	56. $3\frac{2}{3} \div \frac{7}{8}$.
45. $3\frac{1}{2} \div 10\frac{1}{2}$.	51. $3\frac{7}{8} \div \frac{2}{3}$.	57. $3\frac{2}{3} \div 2\frac{7}{8}$.
46. $5\frac{1}{2} \div 3\frac{1}{4}$.	52. $\frac{5}{8} \div 2\frac{1}{2}$.	58. $6\frac{3}{5} \div 2\frac{1}{5}$.
47. $3\frac{1}{8} \div 2\frac{3}{4}$.	53. $\frac{7}{8} \div 2\frac{3}{4}$.	59. $6\frac{4}{5} \div 2\frac{2}{5}$.
48. $2\frac{3}{4} \div 3\frac{7}{8}$.	54. $1\frac{7}{8} \div 2\frac{3}{4}$.	60. $7\frac{4}{5} \div 3\frac{3}{8}$.

PROBLEMS IN DIVISION

1. Mr. Field had $7\frac{3}{8}$ A. of land on the shore of a lake. After he divided it into lots containing $\frac{1}{8}$ A. each, how many lots did he have?

2. We had a sheet of colored paper that was $18\frac{3}{4}$ in. wide. We wished to cut it into strips $\frac{3}{4}$ in. wide. How many strips could we make?

3. How many pieces $\frac{3}{4}$ yd. long can be cut from a roll of ribbon $15\frac{3}{4}$ yd. long?

4. A barrel usually holds $31\frac{1}{2}$ gal. How many barrels of water are there in a tank containing $409\frac{1}{2}$ gal.?

5. At the rate of $2\frac{3}{4}$ mi. an hour, how long will it take a troop of Boy Scouts to hike $13\frac{3}{4}$ mi.?

6. If a $1\frac{3}{4}$-acre field yields $185\frac{3}{4}$ bu. of potatoes, how many bushels does it yield per acre?

7. Helen's father has a car which averages $17\frac{1}{2}$ mi. to each gallon of gasoline. How many gallons will the car use in going $192\frac{1}{2}$ mi.?

8. How many strips of carpet $\frac{3}{4}$ yd. wide will it take to cover the floor of a room $5\frac{1}{4}$ yd. wide?

9. How many posts $7\frac{1}{2}$ ft. long can be made from an old flagpole that is $52\frac{1}{2}$ ft. long?

10. How many ice-cream bricks containing $1\frac{1}{2}$ qt. each can be made from $61\frac{1}{2}$ qt. of ice cream?

11. If an automobile jack raises the car $\frac{3}{8}$ in. each time Frank pushes down the handle, how many times must he push it down to raise the car $3\frac{3}{4}$ in.?

Fractional Relations. Suppose that you have 21 pieces of candy and eat $\frac{1}{3}$ of them. You evidently eat $\frac{1}{3}$ of 21 pieces, or 7 pieces.

To put it another way, suppose you eat 7 pieces of candy out of 21. You evidently eat $\frac{7}{21}$ of the pieces, or $\frac{1}{3}$ of them, which is correct because $\frac{1}{3}$ of 21 pieces is 7 pieces.

Similarly, if you eat 3 pieces of candy out of 10, you eat $\frac{3}{10}$ of the pieces. This is correct because $\frac{3}{10}$ of 10 pieces is 3 pieces.

As another simple illustration, suppose that you wish to find what part the number 2 is of 4. Evidently 2 is $\frac{2}{4}$ of 4, or $\frac{1}{2}$ of 4. As a check, it is easily seen that $\frac{1}{2}$ of 4 is 2.

To find what fraction the first of two numbers is of the second, divide the first number by the second and then express the result in lowest terms.

FRACTIONAL RELATIONS

1. If you eat 6 chestnuts out of 60, what fraction of them do you eat? Is this more or is it less than $\frac{1}{8}$ of them?

2. If your school team wins 8 of 12 games of baseball played, what fraction of the games does it win?

3. In Ex. 2, what fraction of the games does it lose?

4. If 7 of the 28 da. in February are stormy, what fraction of the days are stormy? are not stormy?

Find what part the first of these numbers is of the second:

5. 8, 16.	**7.** 16, 24.	**9.** 24, 28.	**11.** 25, 75.
6. 8, 24.	**8.** 24, 32.	**10.** 25, 35.	**12.** 50, 75.

Fractional Parts. Suppose that there are 40 words in a spelling test, and $\frac{1}{20}$ of them are names of cities. Evidently, $\frac{1}{20}$ of the 40 words, or 2 words, are names of cities.

Now suppose that 2 words in a spelling test are names of cities, and this is $\frac{1}{20}$ of the total number. Evidently, if 2 is $\frac{1}{20}$ of the number, the number of words in the test must be 20×2, or 40.

Again, suppose that you solve 28 of the examples in a test, and that this is $\frac{7}{8}$ of the total number. To find the total number in the test we have

$$\tfrac{7}{8} \text{ of the number} = 28,$$

and so $\quad \frac{1}{8}$ of the number $= \frac{1}{7}$ of 28,

and $\quad$ the number $= 8 \times \frac{1}{7} \times 28$, or 32.

FRACTIONAL PARTS

1. How much is $\frac{1}{4}$ of \$8? $\frac{3}{4}$ of \$8? $\frac{1}{8}$ of 16¢?

2. If 3 is $\frac{1}{4}$ of some number, what is the number?

3. If 6 is $\frac{3}{8}$ of some number, what is $\frac{1}{8}$ of the number? What is the number?

Find the number of which

4. 2 is $\frac{1}{2}$.	11. 12 is $\frac{1}{2}$.	18. 12 is $\frac{2}{3}$.	25. 8 is $\frac{1}{16}$.
5. 2 is $\frac{1}{4}$.	12. 11 is $\frac{1}{3}$.	19. 12 is $\frac{3}{4}$.	26. 9 is $\frac{3}{16}$.
6. 2 is $\frac{1}{8}$.	13. 10 is $\frac{1}{4}$.	20. 12 is $\frac{4}{5}$.	27. 10 is $\frac{5}{16}$.
7. 3 is $\frac{1}{2}$.	14. 15 is $\frac{1}{5}$.	21. 15 is $\frac{3}{8}$.	28. 21 is $\frac{7}{16}$.
8. 3 is $\frac{1}{3}$.	15. 12 is $\frac{1}{6}$.	22. 15 is $\frac{5}{8}$.	29. 45 is $\frac{9}{16}$.
9. 3 is $\frac{1}{4}$.	16. 10 is $\frac{1}{7}$.	23. 14 is $\frac{7}{8}$.	30. 45 is $\frac{15}{16}$.
10. 4 is $\frac{1}{8}$.	17. 25 is $\frac{1}{8}$.	24. 25 is $\frac{5}{8}$.	31. 10 is $\frac{5}{32}$.

A SILENT READING LESSON

In an airplane race the winning plane traveled 328 mi. in 2 hr. What was the average speed in miles per minute?

Since 2 hr. = 120 min., we divide by 120 and find the result to be $2\frac{88}{120}$. We can see better what such a fraction means if we reduce it to lowest terms.

$$\begin{array}{r} 2\frac{88}{120} \\ 120\overline{)328} \\ \underline{240} \\ 88 \end{array}$$

Since 88 is an even number, and 120 ends in zero, both terms of $\frac{88}{120}$ are divisible by 2; that is,

$$\frac{88}{120} = \frac{44}{60}.$$

Similarly, continuing to divide both terms by 2, we have

$$\frac{44}{60} = \frac{22}{30} = \frac{11}{15}.$$

That is, the average speed was $2\frac{11}{15}$ mi. per minute.

In the case of simple fractions like $\frac{4}{6}$, we can easily see at once by what number to divide both terms in order to reduce the fraction to lowest terms.

In the case of fractions like $\frac{88}{120}$, the best way is to continue to divide by the common factors that we see, until there are no more left.

PROBLEMS FOR GIRLS

1. A recipe for biscuits calls for 2 cups of flour, $1\frac{1}{2}$ tablespoonfuls of shortening, $\frac{3}{4}$ cup of milk, 4 teaspoonfuls of baking powder, and $\frac{1}{2}$ teaspoonful of salt. If you wish to make three times the amount called for by this recipe, how much of each should you take?

2. A recipe for molasses cookies calls for 1 cup of molasses, $\frac{1}{2}$ cup of boiling water, $2\frac{1}{2}$ cups of flour, 1 teaspoonful of soda, $1\frac{1}{2}$ teaspoonfuls of ginger, and 4 tablespoonfuls of butter. Write a recipe for five times this quantity.

3. A recipe for pie crust calls for 2 cups of flour, $\frac{3}{8}$ cup of lard, $\frac{1}{2}$ teaspoonful of baking powder, 1 teaspoonful of salt, and $\frac{1}{4}$ cup of cold water. Write a recipe for three times this amount of pie crust.

4. A recipe for rice pudding for three persons calls for $\frac{1}{8}$ teaspoonful of salt, $\frac{1}{4}$ cup of rice, 3 tablespoonfuls of sugar, 2 cups of hot milk, and a little nutmeg for seasoning. Write a recipe for four persons.

5. A cup of shredded codfish weighs 6 oz. This is what fraction of a pound? How many cups of codfish are there in 1 lb.? in $1\frac{3}{4}$ lb.? in $2\frac{3}{4}$ lb.?

6. A tablespoonful of olive oil weighs $\frac{2}{3}$ oz. How many tablespoonfuls will weigh 2 oz.? 1 oz.?

7. Housewives allow 16 tablespoonfuls of dry material to a cup, and 3 teaspoonfuls to a tablespoonful. How many teaspoonfuls of hominy are there to a cup? A teaspoonful of dry hominy is what part of a cup? How many cups will make 24 tablespoonfuls?

PROBLEMS FOR BOYS

1. Mr. Weston sells his sour cherries to Mr. Kane for 8¢ a pound on the trees. Mr. Weston pays Sam 1¢ a quart for weighing the cherries. Sam finds that a quart of cherries averages $1\frac{3}{4}$ lb., and the empty baskets weigh $2\frac{1}{4}$ lb. How much does Mr. Kane pay for a basket of cherries that weighs 46 lb.?

2. How much does Sam receive for the basket of cherries in Ex. 1? How much does Mr. Weston receive after paying Sam?

3. On Saturday Sam kept this record of the boys that Mr. Kane hired to pick the cherries. Fill in the blank spaces and find how much Sam and Mr. Weston received:

Picker	Quarts	Pounds	Due	Sam	Mr. Weston
Henry	21	$36\frac{3}{4}$	\$2.94	21¢	\$2.73
James	24				
Tom	36				
William	42				
Totals					

4. Mr. Weston pays Sam 4¢ a quart for picking sweet cherries, which he sells at his road-side market for 15¢ a pound. If the empty crate weighs $10\frac{1}{4}$ lb., and 1 qt. of cherries weighs $1\frac{3}{4}$ lb., how much does Sam get for picking a crate of cherries weighing $66\frac{1}{4}$ lb.?

5. How much does Mr. Weston make on the crate of cherries in Ex. 4 after paying Sam?

Review of the Principles. Before we leave our work with fractions, we should briefly review the important principles that we studied last year.

REVIEW OF THE PRINCIPLES

1. If we multiply the numerator of a fraction, what does this do to the value of the fraction? Show this by multiplying the numerator of $\frac{1}{3}$ by 2; by 3; by 6.

2. If we divide the numerator, what does this do to the value of the fraction? Show this by dividing the numerator of $\frac{3}{4}$ by 3, considering the special case of $\frac{3}{4}$ of a dollar.

3. If we multiply the denominator, what does this do to the value of the fraction? Show this by multiplying the denominator of $\frac{1}{2}$ by 2.

4. If we divide the denominator, what does this do to the value of the fraction? Show this by dividing the denominator of $\frac{1}{8}$ by 4.

5. If we multiply both terms by the same number, what does this do to the value of the fraction? Show this by multiplying both terms of $\frac{1}{2}$ by 2; by 3; by 4; by 5.

6. What happens to the value of a fraction like $\frac{8}{16}$ if we divide both terms by the same number?

7. If we add the same number to both terms of a proper fraction, what does this do to the value of the fraction? Show this by adding 1 to both terms of the fraction $\frac{1}{2}$; of the fraction $\frac{1}{3}$; of the fraction $\frac{3}{4}$.

8. What is the effect on the value of a proper fraction if we subtract the same number from both terms?

III. DECIMALS

A SILENT READING LESSON

We have already studied decimal fractions and know that such fractions are ordinarily called simply *decimals*. We know that 1.25 is only another way of writing $1\frac{25}{100}$, which is equal to $1\frac{1}{4}$. Other examples are

Decimal	Name	Fraction	Fraction Reduced
0.2	2 tenths	$\frac{2}{10}$	$\frac{1}{5}$
0.25	25 hundredths	$\frac{25}{100}$	$\frac{1}{4}$

We have learned that $0.4 = \frac{4}{10} = \frac{2}{5}$, and also that $0.40 = \frac{40}{100} = \frac{4}{10} = \frac{2}{5}$; that is, we may annex zeros to a decimal without changing its value. In the same way we may cut off zeros from the right of a decimal without changing its value; that is, $0.500 = 0.50 = 0.5$.

We also know that $3.3\frac{1}{3} = 3\frac{1}{3}$, because $3\frac{1}{3} \div 10 = \frac{1}{3}$.

We know that \$0.50 means $\frac{50}{100}$ of \$1, or 50¢. Because we might easily erase the decimal point or not see it at all, it would be easy to mistake \$.50 for \$50. This is the reason why people who have much work to do with numbers usually write \$0.50 instead of \$.50.

We know that the first decimal place, counting to the right from the decimal point, is tenths, and the second is hundredths. Similarly,

0.001 is 1 thousandth,

0.3124 is 3124 ten-thousandths,

3.41267 is 3 and 41,267 hundred-thousandths,

7.001286 is 7 and 1286 millionths.

READING AND WRITING DECIMALS

Copy the following table, filling in the blank spaces:

	DECIMAL	NAME	FRACTION	FRACTION REDUCED
1.	0.5		$\frac{5}{10}$	$\frac{1}{2}$
2.		Four tenths		$\frac{2}{5}$
3.	0.275		$\frac{275}{1000}$	
4.		Eight hundredths		$\frac{2}{25}$
5.	$3.3\frac{1}{3}$			
6.	1.3750			
7.	0.000125			
8.		Eighteen millionths		
9.			$\frac{375}{1000}$	
10.	14.014		$14\frac{14}{1000}$	

Copy these decimals and after each write the name, the fraction, and the fraction reduced, as in the above table:

11. 0.2.	19. 0.4.	27. 12.5.	35. $0.3\frac{1}{3}$.
12. 0.6.	20. 0.40.	28. 1.25.	36. $0.33\frac{1}{3}$.
13. 0.8.	21. 0.400.	29. 17.5.	37. $0.6\frac{2}{3}$.
14. 0.15.	22. 0.440.	30. 1.75.	38. $0.66\frac{2}{3}$.
15. 0.25.	23. 0.444.	31. 1.55.	39. $5.12\frac{1}{2}$.
16. 0.35.	24. 0.500.	32. 15.5.	40. $51.2\frac{1}{2}$.
17. 0.45.	25. 0.550.	33. $1.16\frac{2}{3}$.	41. 51.25.
18. 0.75.	26. 0.555.	34. $11.6\frac{2}{3}$.	42. 5.125.

Addition of Decimals. When we use decimals in measuring, we always carry the measurement to the same number of decimal places; that is, in practical work, we never have to add 2.3 ft., 4.07 ft., and 0.1976 ft. If we can find one measurement to tenths, we can find all to tenths; if we can find one measurement to thousandths, we can find all to thousandths, and so on. Therefore, in practical work all decimals are usually given to the same number of decimal places. If we say that one length is 2.3 ft. and another is 4.07 ft., we mean that the first is 2.30 ft. and the second is 4.07 ft., both to the nearest hundredth of a foot (0.01 ft.).

If asked to add 2.3, 4.07, and 0.1976, the most convenient way is to write these numbers with the decimal points in a column and annex zeros until they all have the same number of decimal places.

2.3000
4.0700
.1976
6.5676

We then add as with whole numbers and place the decimal point in the result below those in the numbers added.

In a column the zero before the decimal point is omitted except when the number comes at the top.

ADDITION OF DECIMALS

Perform the following additions:

1.	2.	3.	4.	5.
4.82	7.962	9.2036	0.12876	5.728398
.68	3.408	5.1279	.27394	.402609
3.82	.973	.3796	.00920	2.002300
1.76	1.720	6.3535	.00876	.000426
4.60	5.600	6.0003	.80096	.578699

In these examples, which represent cases for drill rather than practical cases, annex as many zeros as are necessary to give each of the following sets of numbers the same number of decimal places and then add:

6. 1.2, 38, 4.72, 6.115.

7. 37.962, 0.2, 4, 7.33.

8. 5.2, 0.7, 3.0009, 7.6.

9. 52.7864, 3.4, 0.82, 62.

10. 296.8, 31.04, 0.99678, 3.4.

11. 4.670939, 5.428, 0.98009.

12. 3.2975, 5.575, 0.2376.

13. 34.2, 0.0651, 32.78, 64.29.

Perform the following additions:

14.	**15.**	**16.**	**17.**
4.296	6.0302	0.98324	9.312786
5.175	.7624	1.32785	2.218566
3.872	8.7000	.00726	.352989
.625	9.2555	.00005	2.370000
5.000	5.2078	2.40300	6.828759
.803	9.0237	5.08969	.003625
6.710	.0096	8.12754	8.758432

18. In measuring a city lot a surveyor found that the four sides were 32.8 ft., 66.4 ft., 31.9 ft., and 62.1 ft. What was the perimeter of (the distance around) the field?

19. If a pupil should measure a school playground, which is in the form of a rectangle, and should report that it was 210.7 ft. long and 107.92 ft. wide, what would you say at once was wrong with his measurements? If he was measuring to the nearest 0.1 ft., how should the width be given? If he was measuring to the nearest 0.01 ft., how should the length be given? What is the perimeter of the playground to the nearest 0.1 ft.?

Subtraction of Decimals. In subtracting decimals we arrange the numbers in the same way as in addition. For example, we subtract 3.2980 from 4.0732 as here shown.

4.0732
3.2980
0.7752

We may check the work by adding the result to the number subtracted. If our work is correct, this result is the number from which we subtracted.

SUBTRACTION OF DECIMALS

Perform the following subtractions:

1. 3.7286 .4939	**5.** 5.23842 .36984	**9.** 4.78236 2.92785	**13.** 322.4731 29.6892
2. 5.9268 3.7999	**6.** 0.92307 .86439	**10.** 3.62082 1.48987	**14.** 129.3492 39.8896
3. 8.0607 4.3278	**7.** 5.81082 2.39687	**11.** 9.67802 4.76082	**15.** 242.3481 129.6742
4. 0.9020 .4782	**8.** 6.33034 5.72687	**12.** 33.4285 26.9287	**16.** 304.0000 92.8709

Subtract after copying in the proper form:

17. 2 – 0.7.	**22.** 32.07 – 5.8.	**27.** 7 – 0.29.
18. 3.4 – 2.	**23.** 6.003 – 0.9.	**28.** 0.9 – 0.1276.
19. 47 – 0.8.	**24.** 60.92 – 7.387.	**29.** 3.1 – 2.009.
20. 5.8 – 0.07.	**25.** 4.2807 – 2.9.	**30.** 2.01 – 0.346.
21. 0.1 – 0.09.	**26.** 5.02 – 3.7986.	**31.** 0.98 – 0.098.

Reduction of Decimals to Fractions. As we saw on pages 125 and 213, we can always reduce a decimal to a fraction. For example, take 0.625. After writing it as $\frac{625}{1000}$, we can continue to cancel 5 until we reach $\frac{5}{8}$; that is,

$$0.625 = \frac{625}{1000} = \frac{125}{200} = \frac{25}{40} = \frac{5}{8}.$$

Sometimes we cannot reduce to lower terms the first fraction that we obtain; for example,

$$0.7 = \frac{7}{10}, \quad 0.63 = \frac{63}{100}, \quad \text{and} \quad 0.119 = \frac{119}{1000}.$$

In adding 0.625 to $0.333\frac{1}{3}$, it is easier to use decimals than to reduce to fractions; that is, than to add $\frac{5}{8}$ and $\frac{1}{3}$. In multiplying, it is usually better to use the fraction.

Important Fractional Parts. On page 147 we learned most of the following important relations:

$\frac{1}{2} = 0.50$	$\frac{1}{5} = 0.20$	$\frac{5}{6} = 0.83\frac{1}{3}$	$\frac{1}{10} = 0.10$
$\frac{1}{3} = .33\frac{1}{3}$	$\frac{2}{5} = .40$	$\frac{1}{8} = .125$	$\frac{9}{10} = .90$
$\frac{2}{3} = .66\frac{2}{3}$	$\frac{3}{5} = .60$	$\frac{3}{8} = .375$	$\frac{1}{12} = .08\frac{1}{3}$
$\frac{1}{4} = .25$	$\frac{4}{5} = .80$	$\frac{5}{8} = .625$	$\frac{1}{16} = .06\frac{1}{4}$
$\frac{3}{4} = .75$	$\frac{1}{6} = .16\frac{2}{3}$	$\frac{7}{8} = .875$	$\frac{1}{32} = .03\frac{1}{8}$

REDUCTION OF DECIMALS TO FRACTIONS

Reduce the following to fractions or mixed numbers:

1. 0.875.	3. 0.625.	5. 1.7.	7. 3.5.	9. 0.05625.
2. 0.375.	4. 1.875.	6. 2.6.	8. 7.9.	10. 0.00125.

Write the fraction by which it would be easier to multiply or divide than by

11. 0.75. 12. $0.16\frac{2}{3}$. 13. 0.625. 14. 0.875. 15. $0.333\frac{1}{3}$.

Multiplication of Decimals. If you multiply $\frac{3}{10}$ by $\frac{3}{10}$, what is the result? Is tenths times tenths equal to tenths? to hundredths? to thousandths? If you multiply 0.1 by 0.1, what is the result?

If you multiply $\frac{3}{100}$ by $\frac{7}{10}$, what is the result? Is tenths times hundredths equal to tenths? to hundredths? to thousandths? If you multiply 0.01 by 0.1, what is the result? Give the reason.

$$\boxed{\begin{array}{r} 2.43 \\ \underline{13.5} \\ 1215 \\ 729 \\ \underline{243} \\ 32.805 \end{array}}$$

In multiplying by a decimal, multiply as with whole numbers, and then, beginning at the right, point off as many decimal places in the product (result) as there are decimal places in the two numbers together.

In the example shown, there are two decimal places in one number and one in the other. Hence there are three decimal places in the result.

MULTIPLICATION OF DECIMALS

Perform the following multiplications:

1. $\begin{array}{r} 2.3 \\ \underline{7} \end{array}$	**5.** $\begin{array}{r} 47.2 \\ \underline{3} \end{array}$	**9.** $\begin{array}{r} 32.4 \\ \underline{23} \end{array}$	**13.** $\begin{array}{r} 1.241 \\ \underline{62} \end{array}$	**17.** $\begin{array}{r} 3428.3 \\ \underline{121} \end{array}$
2. $\begin{array}{r} 2.3 \\ \underline{0.7} \end{array}$	**6.** $\begin{array}{r} 47.2 \\ \underline{0.30} \end{array}$	**10.** $\begin{array}{r} 32.4 \\ \underline{2.3} \end{array}$	**14.** $\begin{array}{r} 1.241 \\ \underline{6.2} \end{array}$	**18.** $\begin{array}{r} 34.283 \\ \underline{1.21} \end{array}$
3. $\begin{array}{r} 2.3 \\ \underline{0.07} \end{array}$	**7.** $\begin{array}{r} 4.72 \\ \underline{0.3} \end{array}$	**11.** $\begin{array}{r} 3.24 \\ \underline{2.3} \end{array}$	**15.** $\begin{array}{r} 124.1 \\ \underline{0.62} \end{array}$	**19.** $\begin{array}{r} 3.4283 \\ \underline{12.1} \end{array}$
4. $\begin{array}{r} 0.23 \\ \underline{0.7} \end{array}$	**8.** $\begin{array}{r} 47.2 \\ \underline{0.03} \end{array}$	**12.** $\begin{array}{r} 32.4 \\ \underline{0.23} \end{array}$	**16.** $\begin{array}{r} 12.41 \\ \underline{6.2} \end{array}$	**20.** $\begin{array}{r} 34.283 \\ \underline{0.121} \end{array}$

PROBLEMS IN MULTIPLICATION

1. If a man is driving his car at a speed of 18.8 mi. per hour (often written 18.8 mi./hr.), how far will he go in 2 hr.? in 3 hr.? in 4 hr.?

2. If a freight train averages 28.9 mi./hr., how far will it go in 2 hr.? in 3 hr.? in 4 hr.? in 12 hr.?

3. If an airplane averages 92.8 mi./hr., how far will it go in 7 hr.? in 8 hr.? in 9 hr.?

4. If Mr. Brown spends an average of 2.2¢ per mile for gasoline, to how much would this amount for an automobile trip of 162.8 mi.? Multiply in the usual way with decimals, and then write the result to the nearest cent.

5. If an engine has to pull a train of 38 freight cars, which have an average weight of 47.9 T. each, what is the total weight of the freight cars that it has to pull?

6. In multiplying 37.42 by 1.78, Charles gave the result as 666.0760, Kate gave it as 66.6076, and Fred as 66.0676. Which was right?

7. In multiplying 48.015 by 4.02, Richard gave the result as 19.30203, where there are five decimal places; Mary gave it as 193.02030, where there are also five; and Gertrude gave it as 19302.030, where there are five figures in the whole number. Which was right?

8. In multiplying 37.508 by 4.3, Helen gave the result as 161.2844; Peter also had four decimal places in his result, which was 161.3744; but Florence gave her answer as 1602.844, with only three figures after the decimal point. Which was right?

DRILL CHART IN MULTIPLYING DECIMALS

Numbers 1 to 15, oral

State rapidly the results of these multiplications:

1. 2×1.2.	6. 0.1×1.	11. 2×3.
2. 2×0.12.	7. 0.1×0.1.	12. 2×30.
3. 0.2×1.2.	8. 0.1×10.	13. 2×0.3.
4. 0.2×12.	9. 0.1×0.01.	14. 0.2×30.
5. 0.2×0.12.	10. 0.1×0.001.	15. 0.2×0.3.

Perform the following multiplications, seeing how many correct results you can get in 10 min.:

16. 24×36.	29. 75×124.	42. 125×144.
17. 2.4×36.	30. 7.5×124.	43. 12.5×144.
18. 24×3.6.	31. 75×12.4.	44. 1.25×144.
19. 2.4×3.6.	32. 75×1.24.	45. 125×14.4.
20. 2.4×0.36.	33. 7.5×1.24.	46. 125×1.44.
21. 0.24×3.6.	34. 7.5×12.4.	47. 12.5×14.4.
22. 0.25×3.6.	35. 85×1.25.	48. 1.25×1.44.
23. 25×0.36.	36. 8.5×12.5.	49. 0.125×144.
24. 1.25×36.	37. 85×12.5.	50. 0.125×14.4.
25. 12.5×3.6.	38. 8.5×1.25.	51. 0.125×1.44.
26. 6.8×7.9.	39. 1.9×16.8.	52. 5.75×9.28.
27. 0.79×6.8.	40. 19×1.68.	53. 57.5×928.
28. 0.68×7.9.	41. 0.27×8.5.	54. 0.575×92.8.

A SILENT READING LESSON

We have learned how to divide when one or both numbers are decimals, and we know where to place the decimal point in the result. Let us now review this work.

If we wish to divide 4 by 2, we may indicate this in the fractional form, $\frac{4}{2}$. We then know that

$$\frac{4}{2} = \frac{40}{20} = \frac{400}{200}, \text{ and so on.}$$

If we wish to divide 1.25 by 2.5, we see that

$$\frac{1.25}{2.5} = \frac{12.5}{25} = \frac{125}{250} = \frac{1250}{2500}, \text{ and so on.}$$

Any one of these divisions would give the required result. We may therefore take the easiest one, which is the one that has the smallest whole number for the divisor (the number by which we divide).

$$\begin{array}{r} 0.5 \\ 25\overline{)12.5} \\ \underline{12\ 5} \end{array}$$

In dividing by a decimal, make the divisor a whole number by multiplying both it and the number divided by 10, 100, 1000, or some other power of 10, and then divide as with whole numbers, placing the decimal point in the result above the decimal point in the number divided.

Always place the decimal point before you begin to divide, so that you will not forget it.

Always estimate the result in advance. This will keep you from giving foolish answers.

For example, in $12.5 \div 25$, we see at a glance that 12 is about half of 25. Hence the result must be about 0.5, and could not possibly be 5, 50, or 0.05.

DRILL CHART IN DIVIDING DECIMALS

Numbers 1 to 20, oral

State rapidly the results of the following divisions:

1. $2\overline{)4}$	6. $3\overline{)6}$	11. $5\overline{)25}$	16. $8\overline{)8}$
2. $2\overline{)0.4}$	7. $3\overline{)60}$	12. $5\overline{)2.5}$	17. $8\overline{)0.8}$
3. $2\overline{)0.48}$	8. $3\overline{)0.6}$	13. $5\overline{)0.25}$	18. $8\overline{)80}$
4. $2\overline{)0.04}$	9. $3\overline{)0.06}$	14. $5\overline{)0.025}$	19. $8\overline{)8.8}$
5. $2\overline{)0.048}$	10. $3\overline{)0.66}$	15. $5\overline{)0.555}$	20. $8\overline{)0.88}$

Divide as indicated, keeping a record of your time:

21. $25\overline{)625}$	31. $525\overline{)65,625}$	41. $873\overline{)297,693}$
22. $2.5\overline{)625}$	32. $5.25\overline{)65,625}$	42. $873\overline{)29.7693}$
23. $2.5\overline{)6.25}$	33. $5.25\overline{)656.25}$	43. $87.3\overline{)29.7693}$
24. $25\overline{)62.5}$	34. $5.25\overline{)6.5625}$	44. $8.73\overline{)2.97693}$
25. $2.5\overline{)62.5}$	35. $0.525\overline{)6562.5}$	45. $0.873\overline{)297.693}$
26. $37\overline{)444}$	36. $752\overline{)175,968}$	46. $573\overline{)328,329}$
27. $37\overline{)44.4}$	37. $752\overline{)17.5968}$	47. $5.73\overline{)328,329}$
28. $37\overline{)4.44}$	38. $75.2\overline{)17.5968}$	48. $57.3\overline{)32,832.9}$
29. $3.7\overline{)4.44}$	39. $7.52\overline{)175.968}$	49. $5.73\overline{)32.8329}$
30. $3.7\overline{)44.4}$	40. $0.752\overline{)1.75968}$	50. $0.573\overline{)3.28329}$

A SILENT READING LESSON

When we divide 625 by 4, we may say that the result is 156 with a remainder of 1, or that it is $156\frac{1}{4}$. Now that we know how to use decimals we may divide 625.00 by 4 and obtain the result 156.25, as here shown:

$$\begin{array}{r} 156\text{, remainder } 1 \\ 4\overline{)625}\phantom{\text{, remainder } 1} \end{array} \qquad \begin{array}{r} 156\frac{1}{4} \\ 4\overline{)625\phantom{\frac{1}{4}}} \end{array} \qquad \begin{array}{r} 156.25 \\ 4\overline{)625.00} \end{array}$$

We need not speak of remainders any more, but may continue divisions as far as we wish. In some cases we need to give a result correct to three decimal places, or, as we may say, to give it to the nearest 0.001.

Let us study these three examples in long division:

$$\begin{array}{r} 12.7 \\ 25\overline{)317.5} \\ \underline{25} \\ 67 \\ \underline{50} \\ 175 \\ \underline{175} \end{array} \qquad \begin{array}{r} 5.48 \\ 25\overline{)137.00} \\ \underline{125} \\ 120 \\ \underline{100} \\ 200 \\ \underline{200} \end{array} \qquad \begin{array}{r} 5.708 \\ 24\overline{)137.000} \\ \underline{120} \\ 170 \\ \underline{168} \\ 200 \\ \underline{192} \\ 8 \end{array}$$

In the third case we may continue the division further, and find that the result is 5.708333+, the rest of the figures being 3's. We see, however, that the remainder 8 gives us $\frac{8}{24}$, or $\frac{1}{3}$, and so we may at once write the result as $5.708\frac{1}{3}$, or as 5.708 to the nearest 0.001.

DRILL CHART IN DIVIDING DECIMALS

Divide as many of these as you can in 5 min.:

1. $43\overline{)103.2}$
2. $22\overline{)23.76}$
3. $26\overline{)2.808}$
4. $53\overline{)60.42}$
5. $27\overline{)3.942}$
6. $2.1\overline{)42.21}$
7. $3.1\overline{)4.061}$
8. $7.3\overline{)0.1533}$
9. $0.37\overline{)6.364}$
10. $1.7\overline{)3131.4}$
11. $8.3\overline{)137.78}$
12. $0.42\overline{)15.624}$
13. $0.083\overline{)11.620}$
14. $0.031\overline{)7.0711}$
15. $1.88\overline{)16.168}$

Divide as follows, annexing as many zeros as may be necessary to carry the result in each case to ten-thousandths, so as to give the answer to the nearest 0.001:

16. $41\overline{)21}$
17. $41\overline{)2.1}$
18. $4.1\overline{)21}$
19. $5.1\overline{)2.1}$
20. $2.9\overline{)51.83}$
21. $6.1\overline{)5.663}$
22. $4.1\overline{)239.7}$
23. $0.73\overline{)8.49}$
24. $1.1\overline{)12.32}$
25. $0.81\overline{)0.8268}$
26. $0.94\overline{)63.4}$
27. $0.51\overline{)0.0211}$

Divide as follows, giving results to the nearest 0.01:

28. $5.9\overline{)3.2171}$
29. $3.2\overline{)70.448}$
30. $3.3\overline{)75.988}$
31. $3.2\overline{)0.1116}$
32. $620\overline{)403.93}$
33. $0.63\overline{)0.42294}$
34. $0.34\overline{)1.16371}$
35. $0.52\overline{)3.22998}$
36. $0.42\overline{)1.76841}$
37. $0.42\overline{)0.78267}$
38. $83\overline{)581.084}$
39. $0.31\overline{)7.06894}$

Multiplying by a Mixed Number. We have learned how to divide decimals, and we shall need this work in multiplying decimals by a mixed number.

For example, supposing that a man drives his car at a speed of 18.4 mi./hr., how far does he drive it in $2\frac{3}{4}$ hr.?

$$\begin{array}{r} 18.4 \\ \underline{2\frac{3}{4}} \\ 138 \\ \underline{368} \\ 50.6 \end{array} \qquad\qquad \begin{array}{rr} & 18.4 \\ & \underline{2\frac{3}{4}} \\ \frac{3}{4} \text{ of } 18.4 = & 13.8 \\ 2 \times 18.4 = & \underline{36.8} \\ & 50.6 \end{array}$$

That is, the man drives his car 50.6 mi. in the $2\frac{3}{4}$ hr.

The first of the above solutions is the one that we use ordinarily. The second is given simply to show more clearly the reason for each step.

MULTIPLYING BY A MIXED NUMBER

Perform the following multiplications:

1. 18.4 × $3\frac{1}{4}$	5. 0.184 × $0.07\frac{1}{4}$	9. 4.968 × $0.05\frac{5}{8}$	13. 3.008 × $0.08\frac{1}{4}$
2. 1.84 × $5\frac{3}{4}$	6. 8.184 × $0.08\frac{3}{4}$	10. 2745 × $12\frac{1}{5}$	14. 0.0125 × $35\frac{2}{5}$
3. 0.184 × $7\frac{3}{4}$	7. 4968 × $5\frac{1}{8}$	11. 27.45 × $12\frac{3}{5}$	15. 0.0375 × $0.8\frac{3}{5}$
4. 0.184 × $0.07\frac{1}{2}$	8. 49.68 × $5\frac{3}{8}$	12. 2.745 × $1.2\frac{4}{5}$	16. 0.0393 × $825\frac{1}{3}$

Short Cuts. We shall now review the most important of the short cuts, and shall learn a few more.

1. *To multiply by 5, move the decimal point one place to the right, annexing zeros if necessary, and divide by 2.*

For example, $5 \times 6248 = \frac{1}{2}$ of $62{,}480 = 31{,}240$.

Similarly, to multiply by 0.5, which is merely $\frac{1}{2}$, it is easier to divide by 2.

For example, $0.5 \times 3044 = \frac{1}{2}$ of $3044 = 1522$.

2. *To divide by 5, multiply by 2 and divide by 10.*

For example, $\frac{1}{5}$ of $7205 = 2 \times 720.5 = 1441$.

Similarly, to divide by 0.5, which is $\frac{1}{2}$, multiply by 2.

For example, $307 \div 0.5 = 2 \times 307 = 614$.

3. *To multiply by 25, move the decimal point two places to the right, annexing zeros if necessary, and divide by 4.*

For example, $25 \times 723.6 = \frac{1}{4}$ of $72{,}360 = 18{,}090$.

The reason is that $25 = \frac{100}{4}$. Hence to multiply by 25 is to multiply by 100 and divide by 4.

4. *To divide by 25, move the decimal point two places to the left and multiply by 4.*

For example, $7825 \div 25 = 4 \times 78.25 = 313$.

The reason is that $\frac{1}{25} = \frac{4}{100}$. How do we find $\frac{4}{100}$ of 100?

5. *To multiply by 125, move the decimal point three places to the right, annexing zeros if necessary, and divide by 8.*

For example, $125 \times 4864 = \frac{1}{8}$ of $4{,}864{,}000 = 608{,}000$.

6. *To divide by 125, move the decimal point three places to the left and multiply by 8.*

For example, $78{,}245 \div 125 = 8 \times 78.245 = 625.96$.

PROBLEMS IN SHORT CUTS

1. How much must we pay for 1500 five-cent stamps?

2. If each blow of a hammer drives a spike 0.5 in. into the wood, how many blows will it take to drive it in 4.5 in.?

3. If a pile driver drives a pile an average of 0.5 ft. into the ground at each blow of the hammer, how far will 65 blows drive it into the ground?

4. In Ex. 3, how many blows will it take to drive it 4 ft. 6 in. into the ground?

5. What is the cost of 360 writing tablets at 25¢ each?

6. At 25¢ a gallon, what is the cost of 120 gal. of gasoline? of 148 gal.? of 265 gal.?

7. Find the cost of 372 newspapers at 2.5¢ each.

8. At 2.5¢ each, how many pencils can you buy for $5?

9. If a coal mine produced 1,640,000 T. in 2.5 yr., how much would be produced in 1 yr. at this rate?

10. Find the cost of 400 boxes of crayons at 25¢ a box.

11. The painter was paid 80¢ an hour for painting our schoolhouse last summer. He handed in a bill for 125 hr. of work. What was the amount due him?

12. A buyer for a large department store bought radio sets at $125 each. The bill amounted to $28,125. How many sets did he buy?

13. To fit out a Girl-Scout camp it was necessary to buy 75 tents at $125 each. How much did they cost?

14. Make up a rule for a short cut in dividing a number by 25 × 125.

IV. HOW TO SOLVE PROBLEMS

A SILENT READING LESSON

In the problems worked out in this book the computation is usually put at the right, and questions which we have to answer, or the explanations, are placed at the left.

Sometimes the teacher has put the number work on the board and has asked us to give orally an explanation like the one in the book. At other times we have written out a brief explanation.

Here is a problem and its solution:

If 7 yd. of cloth cost \$4.20, how much will 12 yd. cost?

The number work:

$$\begin{array}{c} 0.60 \\ \dfrac{12 \times \$\cancel{4}.2\cancel{0}}{\cancel{7}} \end{array} \qquad\qquad \begin{array}{r} \$0.60 \\ \underline{\quad 12} \\ \$7.20 \end{array}$$

This work must be done quickly and accurately.

An oral explanation:

Since 7 yd. cost \$4.20,
we see that 1 yd. costs $\frac{1}{7}$ of \$4.20, or \$0.60,
and so 12 yd. will cost $12 \times$ \$0.60, or \$7.20.

A written explanation:

7 yd. cost \$4.20.
1 yd. costs $\frac{1}{7}$ of \$4.20.
12 yd. cost $12 \times \frac{1}{7}$ of \$4.20, or \$7.20.

We do not usually give all these three parts of the solution unless the teacher so directs.

HOW TO SOLVE PROBLEMS

In solving these problems, give the number work and either the oral or the written explanation, as the teacher directs:

1. If Mollie pays 72¢ for 6 lb. of hominy, how much does she pay for 8 lb.?

2. If Mollie buys 5 packages of cornstarch for 90¢, how much does she pay for 8 packages?

3. If 6 lb. of prunes cost $1.26, what do 7 lb. cost?

4. If 8 cans of salmon cost $2.32, what do 5 cans cost?

5. If 4 cans of cottonseed oil cost $3.52, how much do 7 cans cost? How much do 8 cans cost?

6. Mr. Ray's rent for 3 mo. was $192. How much would it be for 5 mo.? How much would it be for 9 mo.?

7. If 8 cans of cocoa cost $2.56, what do 7 cans cost?

8. A dealer pays $63.75 for 5 gross of toothbrushes. How much must he pay for 14 gross?

9. If 42 yd. of linoleum cost $94.50, what do 34 yd. cost? How much will 84 yd. cost?

10. If 16 yd. of flannel cost $10.88, what do 28 yd. cost?

11. If 8 yd. of sheeting cost $8.96, what do 22 yd. cost?

12. If 12 lb. of raisins cost $4.08, what do 8 lb. cost?

13. If 100 sheets of blotting paper cost $6.50, how much do 250 sheets cost? How much do 400 sheets cost? How much do 3750 sheets cost?

14. If 11 yd. of cotton scrim cost $3.63, how much do 18 yd. cost? How much do 44 yd. cost?

A Railroad Time-Table. Here is part of a large railroad time-table which shows the time that a certain express train is scheduled to leave stations between Jacksonville, Fla., and New Orleans, La.:

Miles	Stations	Leaving
0.0	Jacksonville, Fla.	12 30 P.M.
18.3	Baldwin	1 05 P.M.
58.8	Lake City	2 20 P.M.
165.0	Tallahassee	5 45 P.M.
207.6	River Junction	7 05 P.M.
368.7	Pensacola	11 15 P.M.
471.9	Mobile, Ala.	2 55 A.M.
611.6	New Orleans, La.	7 20 A.M.

This time-table also gives the distance of each station from Jacksonville.

PROBLEMS ABOUT THE TIME-TABLE

1. How far is it from Jacksonville to New Orleans? What is the fare at 3.6¢ per mile?

2. Find the distance from Baldwin to Lake City; to Tallahassee; to Pensacola; to Mobile.

3. At 3.6¢ per mile, find the cost of a ticket from Jacksonville to Baldwin; to Tallahassee; to Mobile.

4. At 3.6¢ per mile, find the fare from River Junction to Pensacola; to Mobile; to New Orleans.

5. How long does it take to go by this train from Jacksonville to Pensacola? from Mobile to New Orleans?

6. Make up five other problems about this time-table.

A SILENT READING LESSON

We know that rapidity and accuracy are especially important in solving problems. Here are some suggestions that will help us to improve our work:

Work rapidly and accurately. The business man demands both rapidity and accuracy.

The most important thing is accuracy. Reasonable rapidity usually improves accuracy.

To insure accuracy, always check the work. One of the good checks is to estimate the answer in advance.

Make the figures neatly. Slovenly work is unbusinesslike and leads to inaccuracy.

Put the work in columns. The business man does this because it is quicker and easier and because he is less likely to make mistakes.

Work efficiently. In addition, we add upward because it is the most efficient way. When we are pointing with a pencil, we can see better above it than below it.

Analyze the problems. We think out the steps in advance, stating the reasons to ourselves. *Thinking* makes a business man successful and it makes a pupil a leader.

Use short methods. The greatest complaint that business men make is that the men and women they hire cannot add, subtract, multiply, and divide quickly and accurately. Short methods will help us to overcome this.

Do the work mentally when possible. We do not use pencil and paper to find the cost of $12\frac{1}{2}$ yd. at 64¢ a yard; we use a short method and find the cost mentally. We always watch for chances to do our work this way.

MISCELLANEOUS PROBLEMS

1. At 48¢ a pound, how many packages of tea, each containing 25 lb., can a merchant buy for $3000?

2. If 32 bricks are required to pave a square that is 1 yd. on a side (that is, one that contains 1 sq. yd.), how many bricks will be needed to pave $128\frac{3}{4}$ sq. yd.?

3. A yacht in one of the international races made 30 mi. in 3 hr. 12 min. 30 sec. Write this as minutes and a decimal. To find the average time per mile, by what must we divide this number? What was the average time per mile made by the yacht?

4. If a homing pigeon flies 1000 mi. in $57\frac{3}{4}$ hr., what is the average speed per hour?

5. A cubic foot of pure cast gold weighs 1204 lb., and a cubic foot of granite weighs 172 lb. Gold is how many times as heavy as granite?

6. In a Western irrigation project, 250 mi. of main ditches were put in at an average cost of $10,000 a mile, and 400 mi. of side ditches at an average cost of $1250 a mile. Find the total cost of the project.

7. A load of coal was sold for $17.76. The wagon and coal together weighed 4160 lb., and the wagon was known to weigh 1200 lb. What was the weight of the coal alone? At what price per ton was it sold?

8. Suppose that you wish to curtain four windows, each of which is 6 ft. high and requires two widths of material. If you allow 9 in. on each strip for hemming, how much will the material cost at $1.10 a yard?

A SILENT READING LESSON

Many problems are so easy that we can solve them without using pencil and paper. The following cases show how to think out a solution:

For example, suppose that a dealer pays \$10 for 8 books of the same kind. To find the cost of each book, we see that, since 8 books cost the dealer \$10,

1 book costs $\frac{1}{8}$ of \$10, or \$$1\frac{1}{4}$, which is \$1.25.

Again, suppose that a stationer buys 100 sheets of blotting paper for \$6.50 and retails them at 10¢ a sheet, and that we wish to find how much more than the cost he receives. Since he sells 1 sheet for 10¢, he sells 100 sheets for 100 times 10¢, or \$10. Hence he receives

\$10 − \$6.50, or \$3.50, more than the cost.

Suppose that we wish to find how much a dealer, who pays \$48 for 120 doz. pencils, pays for each pencil. For 1 doz. he evidently pays $\frac{1}{120}$ of \$48 (which we think of as $\frac{1}{12}$ of \$4.80), or 40¢. Hence for

1 pencil he pays $\frac{1}{12}$ of 40¢, or $3\frac{1}{3}$¢.

A dealer pays \$7.20 for 1 doz. knives and sells them at 90¢ each. In finding how much more than the cost he receives, we see that he pays $\frac{1}{12}$ of \$7.20, or 60¢, for each knife. He then receives 90¢ − 60¢, or 30¢, more than the cost on each knife. Hence on

12 knives he receives 12 × 30¢, or \$3.60.

We could have taken 12 × 90¢, or \$10.80, and then subtracted \$7.20; but it is easier to keep the numbers small.

PURCHASES AT THE STORE

All work oral

Using short methods when possible, find the cost of

1. 25 yd. of felt @ \$2.40; @ \$2.48; @ \$2.20.
2. 12 screw drivers @ 30¢; @ 25¢; @ 40¢.
3. 5 yd. of dimity @ 34¢; @ 38¢; @ 46¢; @ 50¢.
4. $12\frac{1}{2}$ lb. of feathers @ 96¢; @ \$1.20; @ \$1.60.
5. 32 yd. of cambric @ 40¢; @ 50¢; @ 60¢; @ 75¢.
6. 8 yd. of cashmere @ \$1.25; @ \$1.37$\frac{1}{2}$; @ \$1.50.
7. 16 yd. of gingham @ 40¢; @ 50¢; @ 75¢; @ 80¢.
8. 20 panes of glass @ 40¢; @ 50¢; @ 60¢; @ 75¢.
9. 25 pairs of shears @ 40¢; @ 64¢; @ 80¢.
10. 11 chisels @ 40¢; @ 50¢; @ 60¢; @ 70¢; @ 90¢.
11. 10 pieces of beading @ 33¢; @ 34¢; @ 36¢; @ 40¢.
12. 25 saws @ \$1.20; @ \$1.60; @ \$1.80.
13. 10 boxes of screws @ 30¢; @ 40¢; @ 38¢.
14. 22 ft. of rope @ 20¢; @ 40¢; @ 70¢; @ 80¢.
15. 12 yd. of linen lawn @ \$1.50; @ \$1.75; @ \$2.
16. 7 gross of screws @ 30¢; @ 31¢; @ 40¢.
17. 3 doz. bolts @ 80¢; @ 81¢; @ 82¢; @ 83¢.
18. 10 yd. of canvas @ 65¢; @ 78¢; @ 87$\frac{1}{2}$¢.
19. 7 lb. of solder @ 30¢; @ 31¢; @ 32¢.
20. 4 doz. spools of basting cotton @ 30¢; @ 32¢; @ 40¢.
21. 11 knives @ 43¢; @ 45¢; @ 55¢; @ 60¢.

Relations of Numbers. Observing the relations between the numbers in a problem often simplifies a solution.

1. If 6 T. of hay cost \$96, what is the cost of 18 T.?

Since 18 is 3 times 6, we see that the cost of 18 T. of hay is 3 × \$96, or \$288.

2. At \$18.50 a ton, what is the cost of 17,500 lb. of hay?

Since 2000 lb. cost \$18.50, 17,500 lb. will cost $\frac{17500}{2000}$ as much. Canceling, we have the result \$161.875, which we give as \$161.88.

$$\frac{\overset{8.75}{\cancel{17500}} \times \$18.50}{\cancel{2000}} = \$161.875$$

To find the cost of a given number of pounds at a given price per ton, point off three figures in the number of pounds, divide by 2, and multiply the price per ton by this result.

RELATIONS OF NUMBERS

1. If 8 T. of coal cost \$84, how much will 16 T. cost?
2. If 3 T. of hay cost \$45, how much will 27 T. cost?

At the following prices per ton, find the cost of

3. 22,500 lb. of coal @ \$13.20; @ \$15.50.
4. 8400 lb. of coal @ \$9; @ \$9.50; @ \$11.20.
5. 38,100 lb. of coal @ \$9.50; @ \$9.75; @ \$11.45.
6. 94,300 lb. of coal @ \$9.25; @ \$9.90; @ \$12.20.
7. 127,500 lb. of coal @ \$8.75; @ \$9.30; @ \$11.75.
8. 242,600 lb. of coal @ \$9.15; @ \$8.75; @ \$10.25.

Buying by the Hundred, Thousand, and Gross. In some kinds of business it is the custom to sell by the hundred (C), by the thousand (M), or by the gross (12 doz.), although smaller quantities are sometimes sold. Here are the ways in which some things are sold:

Envelopes, by the package of 25, by the hundred, or by the box of 500.

Typewriter paper, by the package of 500 sheets, or by the pound.

Buttons, by the gross or by the dozen.

Coal, by the ton of 2000 lb. or by the sack.

Lumber, by the thousand feet.

Bricks, by the thousand.

MAKING LARGE PURCHASES

All work oral

1. At $12 per M, how much will 12 M bricks cost?

2. At 60¢ per C, how much will 12 C envelopes cost?

3. If 7 M bricks cost $70, how much will 14 M cost?

4. At 55¢ per 500 sheets, how much will 2500 sheets of typewriter paper cost?

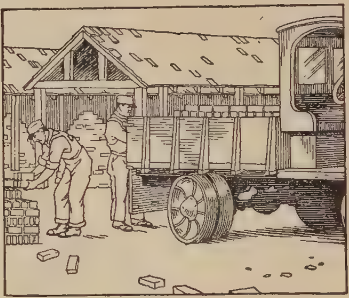
5. If 6 C sheets of blotting paper cost $20, what is the cost of 36 C sheets? of 42 C sheets? of 72 C sheets?

6. If 2 M feet of finest oak cost $300, what is the cost of 8 M feet? of 14 M feet? of 60 M feet?

7. At 80¢ a gross, what is the cost of $1\frac{1}{2}$ gross of buttons? of $2\frac{1}{2}$ gross? of 120 doz.?

BUYING IN LARGE UNITS

1. Find the cost of $4\frac{1}{2}$ M bricks (that is, of 4500 bricks) at $9.80 per M.



2. A man paid $29.40 for $3\frac{1}{2}$ M bricks. At the same rate, how much must he pay for $10\frac{1}{2}$ M bricks?

3. At $9.75 per M, how much will $5\frac{1}{2}$ M bricks cost? How much will $2\frac{1}{4}$ M cost? In giving the answers, disregard any fraction of a cent less than $\frac{1}{2}$¢, and take $\frac{1}{2}$¢ or more as 1¢.

4. At $1.25 a gross, find the cost of $22\frac{1}{2}$ gross of buttons.

5. If 7 M feet of lumber cost $630, how much will 28 M feet cost? Solve by only one multiplication.

6. If the freight on 9 M pounds of goods is $18.70, how much will it be on 27 M pounds at the same rate?

7. A dealer bought 7500 envelopes at $6.80 per M and sold them at 90¢ per C. How much more than the cost did he receive?

8. At $8.40 per ton, find the cost of 5000 lb. of coal.

9. At $12.20 per ton, find the cost of 8400 lb. of coal; of 12,500 lb.; of $12\frac{1}{2}$ T.

10. If blotting paper is sold at $34.50 per M sheets, how much must a dealer pay for 500 sheets?

11. A dealer can buy pasteboard boxes for his goods at $32.50 per M. How much is this per C? per dozen?

V. REVIEW AND DRILL

MINIMUM ESSENTIALS

1. Write 1928 and 1935 in Roman numerals, and LXXIX and CLXXXVIII in common numerals.

Add, subtract (the second number from the first), multiply, and divide (the first number by the second) in each of the following pairs:

2. 6531, 2177.	**5.** 30,195, 6039.	**8.** 31,104, 3456.
3. 18,846, 3141.	**6.** 56,080, 7010.	**9.** 24,258, 4043.
4. 29,547, 4221.	**7.** 28,404, 7101.	**10.** 69,993, 7777.

Add, subtract (the second number from the first), multiply, and divide (both the first number by the second and the second by the first) in each of the following pairs:

11. $\frac{3}{4}$, $\frac{2}{3}$.	**13.** $\frac{2}{3}$, $\frac{5}{8}$.	**15.** $\frac{3}{4}$, $\frac{1}{8}$.	**17.** $\frac{1}{2}$, $\frac{3}{16}$.	**19.** $\frac{3}{8}$, $\frac{5}{16}$.
12. $\frac{3}{8}$, $\frac{1}{3}$.	**14.** $\frac{2}{3}$, $\frac{1}{8}$.	**16.** $\frac{3}{4}$, $\frac{5}{8}$.	**18.** $\frac{5}{16}$, $\frac{1}{8}$.	**20.** $\frac{5}{8}$, $\frac{3}{16}$.

Find the value in each of the following cases:

21. $3\frac{1}{2} + 2\frac{7}{8}$.	**29.** 1.5×68.	**37.** 3.73×42.3.
22. $15 - 2\frac{1}{2}$.	**30.** 1.5×6.8.	**38.** 67.61×3.19.
23. $17 - 3\frac{7}{8}$.	**31.** $75 \div 25$.	**39.** 67.42×9.86.
24. $5\frac{3}{4} \times 5\frac{1}{4}$.	**32.** $7.5 \div 2.5$.	**40.** $493.2 \div 27.4$.
25. $9\frac{1}{8} \times 2\frac{1}{2}$.	**33.** $3.7 \div 0.2$.	**41.** $1.25 \div 0.025$.
26. $3\frac{1}{3} \div \frac{1}{2}$.	**34.** $8 \div 0.0025$.	**42.** $\frac{1}{2}$ of 2.5×6.4.
27. $6\frac{2}{3} \div \frac{1}{2}$.	**35.** $1425 \div 2.5$.	**43.** $\frac{3}{4}$ of 6.4×1.6.
28. $6\frac{2}{3} \div 3\frac{1}{3}$.	**36.** 0.15×26.92.	**44.** $\frac{3}{8}$ of 6.8×9.8.

PROBLEMS WITHOUT NUMBERS

All work oral

1. If you are given a decimal, how do you express it as a fraction in lowest terms?

2. If you are to find a certain fractional part of a number, how do you express the part as a decimal?

3. If you know the cost of a certain number of things of the same value, how do you find the cost of one of them?

4. If you know the cost of a certain number of things of the same value, how do you find the cost of a certain other number of these things?

5. If you know what a given fraction of a number is, how do you find the number?

6. If you know how many bricks are needed for a certain wall, how do you find the number needed for another wall of the same thickness but a certain number of times as long and a certain other number of times as high?

7. If you wish to add two fractions having different denominators, how do you do it?

8. If you can buy a suit for a certain fraction "off" the regular price, how do you find how much you must pay for the suit?

9. If two numbers have been multiplied and you are given the number of decimal places in the result, and the number of decimal places in one of them, how can you find the number of decimal places in the other?

PROBLEMS FOR COMPLETION

1. The three sides of a triangle are respectively 3.7 in., 4.2 in., and 5.6 in. Complete the problem in any reasonable way and solve it.

2. On an automobile trip we went 28.1 mi. the first hour and 26.8 mi. the second hour. Complete the problem and solve it.

Complete and solve each of the following problems:

3. A cubic foot of water weighs 62.5 lb., and ice is 0.92 as heavy as water. A certain block of ice contains 8.3 cu. ft.

4. Clay is 1.2 times as heavy as water, and 1 cu. ft. of water weighs 62.5 lb.

5. Tin is 7.29 times as heavy as water, and 1 cu. in. of water weighs 0.58 oz.

6. A cubic foot of cast iron weighs 450 lb., and a cubic foot of water weighs 62.5 lb.

7. A circular race track is 190.4 ft. across, and the distance around it is $3\frac{1}{7}$ times the distance across.

8. A man used 72,000 cu. ft. of gas in 4 mo., and the gas company charged $1.10 per 1000 cu. ft.

9. Kate has $45 in the bank. Her father gives her $\frac{1}{5}$ as much more to put in the bank.

10. Richard buys $18.40 worth of books and pays $\frac{3}{4}$ of this amount, his mother paying the rest.

11. A mail plane flew from Washington to New York in 1 hr. 34 min. at an average speed of 138 mi. per hour.

12. John bought a suit marked $16.60 at "$\frac{1}{4}$ off."

MISCELLANEOUS PROBLEMS

1. If you are on an express train which is averaging 51.6 mi./hr., how far will you go in 2 hr.? in $2\frac{1}{2}$ hr.? in $2\frac{3}{4}$ hr.? in 3 hr. 20 min.?

2. If an airplane averages 82.4 mi./hr., how far will it go in 3 hr.? in $3\frac{1}{4}$ hr.? in $3\frac{3}{4}$ hr.? in 4 hr. 45 min.?

3. If the speedometer of your automobile registers 24.8 mi./hr., how far will you go in $4\frac{3}{4}$ hr. if this rate is kept up? How far will you go in $5\frac{1}{4}$ hr.? in $3\frac{1}{2}$ hr.? in 2 hr. 10 min.?

4. If you are buying velvet at $4.80 a yard, how much must you pay for $3\frac{3}{4}$ yd.? for $4\frac{1}{8}$ yd.? for $5\frac{7}{8}$ yd.? for 24 in.? for 48 in.?

5. How long will it take a steamer to go 48.8 mi. at the rate of a mile in 3.4 min.?

6. A freight train traveling at the rate of 24.8 mi./hr. travels how many miles in 3 hr. 45 min.?

7. At $3.20 a yard, how much must you pay for $5\frac{1}{2}$ yd. of goods? for $5\frac{3}{4}$ yd.? for $6\frac{5}{8}$ yd.?

8. If we multiply $2\frac{1}{2}$ by 3.4, we get the same result as if we multiply 3.4 by $2\frac{1}{2}$. What is the result?

9. At 3.6 ¢ a mile how much will a railroad ticket cost from Washington to Richmond, a distance of 116.5 mi.?

10. A cubic foot of water weighs 62.5 lb. What is the weight of $17\frac{1}{2}$ cu. ft. of water?

11. If you can walk at the rate of 1 mi. in 20 min., how long will it take you to walk $1\frac{3}{4}$ mi.?

THRIFT IN THE HOME

1. Mrs. Rowe can save at least 80¢ a week by going to the market and buying in person. Counting 52 wk. to the year, how much will she save in this way in a year?

2. Henry says that he will raise vegetables to help cut down the high cost of living. Allowing $1.80 for plowing, $3.25 for fertilizer, $1.50 for seed, and 85¢ each week for 22 wk. for wages, which his mother pays him, what is the entire cost of the vegetables for the season?

3. Henry makes his mother a fireless cooker by stuffing a box with excelsior and lining it with asbestos. By using the cooker Mrs. Rowe saves on her gas bills an average of $1.20 a month. How much does she save in a year?

4. At a bargain sale Henry buys a suit of clothes marked $30 at $\frac{1}{4}$ off, three shirts marked $2.50 at $\frac{1}{10}$ off, a pair of shoes marked $6.25 at $\frac{1}{5}$ off, a dozen 30-cent handkerchiefs at $\frac{1}{6}$ off, and a hat, a pair of gloves, and some ties amounting to $9 at $\frac{1}{5}$ off. How much does he save in all?

5. Mrs. Rowe can buy rolled oats in 20-ounce packages for 13¢ a package, or she can buy rolled oats of the same quality in bulk at 9¢ a pound. If she wishes to buy 20 lb., how much does she save if she buys it in bulk?

6. Mrs. Rowe can buy salad oil at 68¢ a quart or at 38¢ a pint. How much does she save if she buys 4 qt.?

7. Mrs. Rowe can buy sugar in packages at $9\frac{1}{2}$¢ a pound or in bulk at 9¢ a pound. How much does she save if she buys 10 lb. in bulk?

VI. LITTLE EXAMINATIONS

I. 1. Reduce $37\frac{1}{2}$ to halves.

2. $\frac{2}{3} + \frac{3}{4} + \frac{1}{2} + \frac{5}{8} + 2\frac{1}{4}$.

3. $1675\frac{1}{2} - 156\frac{7}{8}$.

4. $27 \times \$231.66\frac{2}{3}$.

5. $\frac{3}{4}$ of \$164.48.

6. $3\frac{3}{4} \times 164$.

7. $8\frac{3}{4} \div 3\frac{1}{2}$.

8. $6 \times \$1.12\frac{1}{2}$.

II. 1. 0.28×1247.6.

2. $5.527 - 0.378$.

3. $2897.28 \div 1.44$.

4. $0.16\frac{2}{3} \times \$248.46$.

5. $1.03 \times 84\frac{1}{2}$ ft.

6. $0.5 \times \$7876$.

7. $0.18 \times \$675$.

8. $4.12 \times \$990$.

III. 1. $7.147 \div 0.05$.

2. 0.8×0.08.

3. $0.16\frac{2}{3} \times \$78.60$.

4. $7.147 + 0.968 + 1.736$.

5. $71.47 + 16.98 - 17.36$.

6. $0.03\frac{3}{4} \times 4$ ft.

7. $12\frac{7}{8} \times 8$ yd.

8. $0.8 \times \$85.50$.

9. $2.8 \times \$75$.

10. $2.75 \times \$800$.

IV. 1. $5\frac{7}{8} = (?)$ eighths.

2. $3.5 = (?)$ fourths.

3. $7.00 - 0.77$.

4. $34.56 \div 0.72$.

5. 0.72×2434.56.

6. $29 \div 7\frac{1}{4}$.

7. 25×9664.

8. 125×65.68.

9. 3.75×65.68.

10. $1375 \div 1.25$.

V. 1. How much is \$475 less 0.08 of itself?

2. How much is \$850 added to 0.16 of itself?

3. Add 2.478, 0.396, 2.073, and 7.136.

4. From $62\frac{7}{8} + 3\frac{3}{4}$ take $26\frac{1}{2} + 4\frac{5}{8}$.

5. Multiply 474.24 by 12.5, and check by division.

CHAPTER IV

I. BILLS, RECEIPTS, AND ACCOUNTS

A SILENT READING LESSON

If we buy anything at a store, we must pay for it unless we *have an account* there. This expression means that our record for paying promptly what we owe is so good that the dealer will let us *charge* what we buy and pay him at the end of the month or early in the next month. At that time he will send a *bill*, which shows what we owe.

There are different ways of making out a bill. For example, the *heading* of the bill may look like this model:

Holmes, Rogers & Company
Grocers
1927 North Maple St., Seattle

SOLD TO Mrs. Robert Roberts
4289 East Pacific St.
Feb. 1, 1928

The heading may also have a form something like this:

SEATTLE, Feb. 1, 1928

Mrs. Robert Roberts
4289 East Pacific St.

BOUGHT OF Holmes, Rogers & Company
1927 North Maple St.

Bills. Bills are often ruled with only one column in which to put down the amount due for each purchase.

They may also be ruled with two columns, as shown on page 247. The amount of each purchase is then put in the column at the left, and any payments made or the value of goods returned are put in the one at the right.

Here is a bill showing the single column for purchases. It also shows the receipt stamp, signed by the cashier (with initials), which indicates that the bill has been paid.

TOPEKA, KANS., May 1, 1929

Mrs. Stephen Stephenson
4096 West Essex Place

Bought of **MEAD & KING**

GROCERS

8074 SOUTH STREET

Apr.	27	2 bags white flour	1.35	2	70
		10 lb. hominy	7¢		70
				3	40

RECEIVED PAYMENT
MAY 4, 1929
MEAD & KING
PER L. T. F.

Later on we shall find that bills are often paid by check, and that the check itself is a receipt. On this account few bills of any size are receipted if the buyer has a charge account.

Sometimes the symbol @, which means "at," is put before the price of each article. For example, "10 lb. hominy @ 7¢" means 10 lb. at 7¢ a pound, but this is usually understood without being written.

Bills with Double Rulings. The following bill shows the double ruling for purchases and *credits*, the latter including any payments made "on account" or goods returned:

THE MILLER MARSHALL CO.

7296 West Salina Ave.

LOS ANGELES, CALIF.

Mrs. Richard X. Doe
5978 So. Pleasant Ave.

June 1, 1929

DATE		ITEM		PURCHASES		CREDITS	
May	16	24 yd. cretonne	1.10	26	40		
	18	2 pr. gloves	3.50	7	00		
		8 yd. velvet	4.20	33	60		
	19	2 pr. gloves	3.50			7	00
				67	00		
		Credit		7	00		
		Balance due		60	00		

The bill shows purchases amounting to \$67. It also shows that the gloves were returned and credited the day after they were purchased. The balance due is \$60.

MAKING OUT BILLS

Make out bills, ruled for purchases only, for the following items, and receipt each bill:

1. Feb. 7, 3 yd. satin @ \$3.60, 7 yd. flannel @ \$1.55.

2. Mar. 9, 2 doz. plates @ \$10.40, ½ doz. cups and saucers @ \$10.50; Mar. 12, ½ doz. tumblers @ \$2.50.

3. Apr. 6, 4 doz. eggs @ 52¢, 10 lb. sugar @ 8½¢; Apr. 8, 3 lb. butter @ 35¢, 2 doz. oranges @ 60¢.

4. Jan. 4, 5 lb. beef @ 38¢; Jan. 5, 3 lb. pork @ 28¢; Jan. 6, 6 lb. chicken @ 36¢.

Make out bills, ruled for purchases and credits, for the following items, and receipt each bill:

5. Oct. 6, 4 ties @ \$2.75; Oct. 15, 3 yd. crêpe @ \$4.95, 15 yd. muslin @ 15¢, $1\frac{1}{4}$ yd. silk @ \$1.60.

6. Nov. 1, 2 lb. fancy butter @ 55¢, 2 doz. eggs @ 68¢, 2 lb. powdered sugar @ 10¢; Nov. 8, 6 packages soap flakes @ 9¢, 2 boxes bacon @ 59¢, $\frac{1}{2}$ lb. cheese @ 40¢.

7. Apr. 7, 2 packages washing soda @ 10¢, 2 packages puffed rice @ 20¢, 3 packages cornflakes @ 12¢; Apr. 12, $\frac{1}{4}$ lb. citron @ 72¢, 5 lb. granulated sugar @ 8¢; Apr. 13, credit, 3 packages cornflakes @ 12¢, returned.

8. Mar. 7, $2\frac{1}{2}$ yd. silk @ \$4.50; Mar. 9, 5 yd. silk @ \$4.50; Mar. 12, 1 gown, \$9.50; Mar. 13, credit, 1 gown, \$9.50, returned.

9. Mar. 1, due from Feb. 1, \$12.75; Mar. 2, $1\frac{3}{4}$ lb. salmon @ 80¢; Mar. 4, $6\frac{1}{4}$ lb. roast @ 40¢; Mar. 5, credit, cash, \$12.75; Mar. 8, $5\frac{1}{2}$ lb. chicken @ 32¢.

10. Apr. 2, 1 double boiler, \$1.50; Apr. 4, 2 aluminum sauce pans @ \$2.75; Apr. 6, 2 wire strainers @ 12¢; Apr. 6, credit, 1 saucepan, \$2.75, returned; Apr. 9, $\frac{1}{2}$ doz. dish cloths @ \$1.64; Apr. 15, $\frac{7}{12}$ doz. tumblers @ \$8.40.

11. Apr. 12, 4 chairs @ \$7.75; Apr. 13, 2 rocking chairs @ \$15.25; 1 dining table, \$38.75; Apr. 14, credit, 1 rocking chair, \$15.25, returned.

12. May 8, $3\frac{1}{2}$ yd. canvas @ 90¢; May 9, 1 scarf, \$3.50; May 10, $6\frac{1}{2}$ yd. satin @ \$4.60; May 10, credit, 1 scarf, \$3.50, returned; May 14, $2\frac{3}{8}$ yd. velvet @ \$3.20.

Receipts. Sometimes a separate receipt is given instead of one stamped or written upon a bill. For example, if you employ a person to do some work for you, you might ask him to give you a receipt when you pay him.

The following model shows a simple form of receipt:

$28.50 DES MOINES, IA., March 15, 1929

Received from John Doe

Twenty-eight and 50/100 Dollars

for payment in full for grading lawn

Richard Roe

WRITING RECEIPTS

Write the receipts, dated today at the place where you live, which Richard Roe would give to John Doe for

1. $75.50, in full for painting a garage.

2. $8.75, in full for lumber furnished.

3. $250, for the balance due on an automobile.

4. $32.50, for building and installing a radio set.

Write receipts for the following amounts paid by you to different persons for work done, dating the receipts today at the place where you live and using play names:

5. $2.	**7.** $1.50.	**9.** $3.25.	**11.** $6.50.	**13.** $15.75.
6. $3.	**8.** $2.75.	**10.** $5.00.	**12.** $10.00.	**14.** $20.00.

PROBLEMS IN THRIFT

1. Play that you have an allowance of $5 a month for buying things that you need in school and for other expenses. Make out a budget for next month showing how you would like to spend your money. Try to save a little for opening a bank account.

2. Play that you are to manage a house next month, where you will have to buy food for a family of four and pay the rent, gas bill, and other necessary expenses, except clothing. Play that you have $100 for the month, and make out a budget showing how the money is to be spent. Do not be extravagant, and try to see how people have to plan in order to get along on a fixed amount.

3. Suppose that in Ex. 2 you allow $15 for food for a week. Inquire about food prices where you live, and make an account, the left side showing the amount allowed ($15) and the right the dates and nature of the probable expenses. Keep within the $15; in a few years you may have to do something of this kind in earnest.

4. From newspapers or from notices in store windows, make up and bring to class next time a few statements about the reductions that stores often make at sales. Try to show how you can save money by being careful about buying things at the right time, and make up an example about it.

5. Tell the class what you mean by saying that you returned some goods to a store and had them "credited to your account."

II. DENOMINATE NUMBERS

A SILENT READING LESSON

Last year we learned the common tables of measure. We shall now review these tables and shall learn a few new ones. Here is the table of length:

12 inches (in.) = 1 foot (ft.)
3 feet = 1 yard (yd.)
$5\frac{1}{2}$ yards, or $16\frac{1}{2}$ feet = 1 rod (rd.)
320 rods, or 5280 feet = 1 mile (mi.)

We know how to *reduce* from one unit to another; for example in reducing $2\frac{1}{2}$ ft. to inches, we have

$$1 \text{ ft.} = 12 \text{ in.},$$

and so $\quad 2\frac{1}{2}$ ft. $= 2\frac{1}{2} \times 12$ in., or 30 in.

Similarly, in reducing 40 in. to feet., we have

$$1 \text{ in.} = \tfrac{1}{12} \text{ ft.},$$

and so $\quad 40$ in. $= 40 \times \frac{1}{12}$ ft., or $3\frac{1}{3}$ ft.

In reducing 4 yd. 2 ft. 7 in. to inches, we may first change both yards and feet to inches, as follows:

$$\begin{array}{rr} 4 \times 36 \text{ in.} = & 144 \text{ in.} \\ 2 \times 12 \text{ in.} = & 24 \text{ in.} \\ & \underline{7 \text{ in.}} \\ \text{Adding, we have} & 175 \text{ in.} \end{array}$$

Some prefer to reduce first to feet, and then to inches, as shown at the right.

$$\begin{array}{llll} 4 \text{ (yd.)} & 2 \text{ (ft.)} & 7 \text{ in.} & \\ \underline{3} & & & \\ & \underline{12 \text{ (ft.)}} & & \\ & 14 \text{ (ft.)} & & \\ & \underline{12} & & \\ & & \underline{168 \text{ (in.)}} & \\ & & 175 \text{ in.} & \end{array}$$

TABLE OF LENGTH

1. Mollie needs 60 in. of braid for a dress. Express this in yards and a fraction, as she would do in buying it.

2. Kate has $2\frac{3}{4}$ yd. of lace. She needs to use 40 in. on a waist. How many inches will she have left? how many yards; that is, how many yards and a fraction?

3. When Fred won the 100-yard dash, his sister asked how many rods he had to run. How many was it?

4. In a 3-mile hike, how many yards do the Boy Scouts go? How many feet? For practical purposes, no one would ever measure this distance in inches, but it is interesting to know what it is. How many inches is it?

Make the following reductions:

5. 72 in. to feet.
6. 72 in. to yards.
7. 72 ft. to inches.
8. 72 yd. to feet.
9. 72 rd. to yards.
10. 72 rd. to feet.
11. 2 ft. 3 in. to inches.
12. 2 ft. 3 in. to feet.
13. 7 yd. 8 in. to inches.
14. 7 yd. 8 in. to feet.
15. 16 yd. 18 in. to rods.
16. 16 yd. 18 in. to feet.

If your teacher so directs, make these reductions:

17. 7 yd. 1 ft. 20 in. to inches; to feet and inches.
18. 2 rd. 2 yd. 2 ft. to feet; to yards; to yards and feet.
19. 1 mi. 75 rd. 2 yd. to yards; to rods.
20. 2 mi. 160 rd. $8\frac{1}{4}$ ft. to feet; to rods.
21. 175 in. to yards; to yards and feet.

Square Measure. Read and learn the following table:

144 square inches (sq. in.)	**= 1 square foot (sq. ft.)**
9 square feet	**= 1 square yard (sq. yd.)**
$30\frac{1}{4}$ square yards	**= 1 square rod (sq. rd.)**
160 square rods	**= 1 acre (A.)**
640 acres	**= 1 square mile (sq. mi.)**

Cubic Measure. Read and learn the following table:

1728 cubic inches (cu. in.)	**= 1 cubic foot (cu. ft.)**
27 cubic feet	**= 1 cubic yard (cu. yd.)**

SQUARE AND CUBIC MEASURE

1. Find the length and width of your schoolroom, each to the nearest foot. If you multiply the number of feet in the length by the number of feet in the width, you will have the number of square feet in the area of the ceiling. Find this number.

2. In Ex. 1 find the area in square yards.

3. It may interest you to know the area in Ex. 1 in square inches. Express it in this way.

4. Find or estimate the height of your schoolroom to the nearest foot. From this and the measurements taken in Ex. 1, find the number of square feet in each wall.

5. In Ex. 4 find the number of square yards.

Make the following reductions:

6. 3 sq. ft. 72 sq. in. to square inches.

7. 1728 sq. in. to square feet; to square yards.

8. 540 cu. ft. to cubic yards; 540 cu. yd. to cubic feet.

Table of Weight. Read and review this table of weight:

16 ounces (oz.) = 1 pound (lb.)
100 pounds = 1 hundredweight (cwt.)
2000 pounds = 1 ton (T.)

TABLE OF WEIGHT

1. What is your own weight? It may interest you to know this in ounces. Express it in this way.

2. You never thought of your weight in tons; in fact, no one would ever speak of a person's weight in this way. It may interest you, however, to find what fraction of a ton you weigh. Express it in this way.

3. It is not unusual, however, to express ounces as a fraction of a pound. Do this in the case of 8 oz.; of 4 oz.; of 2 oz.; of 10 oz.; of 12 oz.

4. If you buy $2\frac{1}{2}$ lb. of meat, you buy how many ounces more than 2 lb.? If you buy 1 lb. 12 oz. of cheese, how many ounces do you buy?

Make the following reductions:

5. 32 oz. to pounds.
6. 32 lb. to ounces.
7. 32 T. to pounds.
8. $2\frac{3}{4}$ T. to pounds.
9. $2\frac{3}{4}$ lb. to ounces.
10. $2\frac{3}{4}$ oz. to pounds.

11. In Ex. 10 you found, as in other similar cases, that you had to express $2\frac{3}{4}$ oz. as a fraction of a pound. Now express it as a decimal part of a pound.

12. Express 17,500 lb. as tons; as hundredweight.

13. Express 365,000 lb. as tons; 365 T. as pounds.

Liquid Measure. Read and review the following table:

2 pints (pt.) = 1 quart (qt.)
4 quarts = 1 gallon (gal.)

Dry Measure. Read and review the following table:

2 pints (pt.) = 1 quart (qt.)
8 quarts = 1 peck (pk.)
4 pecks = 1 bushel (bu.)

LIQUID AND DRY MEASURE

1. If you drink 1 pt. of milk each day, how many quarts do you drink in 5 da.?

2. If you drink 1 qt. of milk each day, how many pints do you drink in 5 da.?

Make these reductions of liquid measures:

3. 15 qt. to pints.
4. 17 pt. to quarts.
5. 3 gal. 2 qt. to quarts.
6. 55 qt. 1 pt. to pints.

7. If you buy $1\frac{1}{2}$ bu. of potatoes, how many pecks do you buy? If you buy $1\frac{1}{2}$ pk. of green peas, how many quarts do you buy?

Make these reductions of dry measures:

8. 19 pt. to quarts.
9. 19 pt. to pecks.
10. 1 bu. 2 pk. to pecks.
11. 16 pk. 4 qt. to quarts.

If the teacher so directs, make these reductions:

12. 2 bu. 3 pk. 5 qt. to quarts; to pecks; to pints.
13. 2 gal. 3 qt. 1 pt. to pints; to quarts.

Time. Read and review the following table of time:

60 seconds (sec.) = 1 minute (min.)
60 minutes = 1 hour (hr.)
24 hours = 1 day (da.)
7 days = 1 week (wk.)
12 months (mo.) = 1 year (yr.)

Money. Read and review the following table of money:

10 mills = 1 cent (ct., c., or ¢)
10 cents = 1 dime (d.)
10 dimes = 1 dollar ($)
100 cents = 1 dollar

TABLES OF TIME AND MONEY

1. How many months and days is it from your last birthday to today? Write your age in years, months, and days.

2. You may be interested to know how many months old you are. Write your age in months and days. Then give it in days, which is even more interesting.

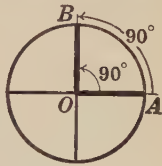
Make the following reductions:

3. $2\frac{1}{2}$ hr. to minutes.
4. $2\frac{1}{2}$ min. to seconds.
5. $2\frac{1}{2}$ wk. to days.
6. $2\frac{1}{2}$ yr. to months.
7. $2.50 to dimes.
8. $2.50 to cents.
9. 370¢ to dimes.
10. 480¢ to dollars.

11. How many days are there in a common year? in a leap year? When is the next leap year?

12. Reduce 1 wk. 2 da. 15 hr. to days; to hours.

Angle Measure. The length of a circle (that is, the distance around the space inclosed by the curve line) is called the *circumference*, and any part of the circle, as from A to B in this figure, is called an *arc*.



In measuring arcs, the unit used is the *degree* (written 1°), and this unit is $\frac{1}{360}$ of the circumference. In the figure it is evident that the size of the angle at O between the lines OA and OB is related to the size of the arc between A and B. Accordingly, we measure angles in degrees, and say that an angle, like the one between OA and OB, which cuts off a fourth of a circumference is a *right angle* and contains $\frac{1}{4}$ of 360°, or 90°.

Similarly, if a wagon wheel makes $\frac{1}{6}$ of a revolution, each spoke turns through an angle of $\frac{1}{6}$ of 360°, or 60°; if it makes $\frac{1}{2}$ of a revolution, each spoke turns through an angle of 180°; and if it makes $1\frac{1}{2}$ revolutions, each spoke turns through an angle of $1\frac{1}{2} \times 360°$, or 540°.

Read and learn the following table of angle measure:

60 seconds (″) = 1 minute (′)
60 minutes = 1 degree (°)

ANGLE MEASURE

Make the following reductions:

1. 540″ to minutes.
2. 540′ to seconds.
3. 540′ to degrees.
4. 285′ to degrees.
5. 2° 10′ to minutes.
6. 2′ 10″ to seconds.
7. 3° 3′ 3″ to seconds.
8. 5° 10′ 20″ to seconds.

Counting Paper. Read and learn this counting table:

$$\textbf{24 sheets, or 25 sheets} = \textbf{1 quire}$$
$$\textbf{20 quires} = \textbf{1 ream}$$

The quire of 24 sheets (480 sheets to the ream) is used in counting stationery and folded paper. The quire of 25 sheets (500 sheets to the ream) is used for unfolded paper. Paper is sold also by the pound.

PROBLEMS IN MEASURES

1. At 50¢ a quire, how much do 16 quires of paper cost?

2. At $16\frac{2}{3}$¢ a quire, what is the cost of 24 quires?

3. From a piece of tin containing $7\frac{1}{2}$ sq. ft. Rob cuts 725 sq. in. How many square inches are left?

4. How many square rods are there in a field which contains $\frac{3}{4}$ A.? in one which contains $1\frac{7}{8}$ A.?

5. A strip of carpet is 38 yd. 2 ft. long. What is the length of the strip in feet?

6. In excavating a cellar 540 cu. yd. of earth are removed. How many cubic feet of earth are removed?

7. A machinist is welding together two pieces of steel in such a way that they make an angle equal to $\frac{3}{4}$ of a right angle. How many degrees are there in this angle?

8. In sailing, a point is $\frac{1}{8}$ of a right angle. A boat's course was changed 6 points. How many degrees was this?

9. The sum of all the angles in a figure of five sides is 540°. If the angles are all equal, how many degrees are there in each one? How many minutes are there?

Adding Compound Numbers. Suppose we know that a schoolhouse stands 44 ft. 8 in. from the street and that the street is 40 ft. 10 in. wide. If we wish to find the distance from the schoolhouse to the opposite side of the street, we might measure it, but it is easier to add the given numbers.

ft.	in.
44	8
40	10
85	6

Adding the inches first, we have 18 in., or 1 ft. 6 in. We therefore write 6 under inches and add 1 to feet. The result is 85 ft. 6 in., which is the distance that we wished to find.

That is, we add compound numbers in much the same way as we add ordinary whole numbers. In ordinary numbers ten units make one unit of the next higher order, but in compound numbers the number of units required to make the next higher one varies with the measure used.

ADDING COMPOUND NUMBERS

Add as follows:

	ft.	in.		sq. ft.	sq. in.		yd.	in.		lb.	oz.
1.	32	11	**3.**	36	40	**5.**	34	12	**7.**	236	12
	16	8		74	75		10	24		364	8
	14	4		31	62		26	17		228	6

	ft.	in.		sq. ft.	sq. in.		yd.	in.		lb.	oz.
2.	37	10	**4.**	29	28	**6.**	38	10	**8.**	486	14
	26	8		64	96		7	8		324	13
	45	3		9			26	8		42	7
	8	7		45	94		44	9		238	11
	13	10		27	48		22	19		112	8

Subtracting Compound Numbers. Suppose that in a room 18 ft. 5 in. square you have put up picture molding on three sides and have a piece 9 ft. 7 in. long for the fourth side. How much more do you need for this side of the room?

In subtracting 9 ft. 7 in. from 18 ft. 5 in., we proceed as we would in the case of subtracting $9\frac{7}{12}$ from $18\frac{5}{12}$; that is, we think of 18 ft. 5 in. as 17 ft. 17 in.

ft.	in.
18	5
9	7
8	10

First subtracting the inches and then the feet, the result is 8 ft. 10 in.; that is, you need 8 ft. 10 in. of molding.

SUBTRACTING COMPOUND NUMBERS

1. A grocer has a piece of cheese weighing 7 lb. 9 oz. If he sells a piece weighing 1 lb. 12 oz., how much has he left?

2. If Bertha has a roll of ribbon 18 yd. 8 in. long and cuts off 9 yd. 28 in., how much ribbon is left in the roll? How much less than 10 yd. is left?

Subtract as follows:

	lb.	oz.		bu.	qt.		ft.	in.		A.	sq. rd.
3.	48	14	**6.**	46	10	**9.**	62	10	**12.**	76	105
	22	8		29	16		28	4		38	118
	bu.	pk.		qt.	pt.		lb.	oz.		sq. ft.	sq. in.
4.	40	1	**7.**	96		**10.**	50	10	**13.**	98	102
	28	2		43	1		36	14		49	128
	gal.	qt.		ft.	in.		yd.	in.		cu. ft.	cu. in.
5.	22	2	**8.**	30	$5\frac{1}{2}$	**11.**	58	22	**14.**	76	272
	15	3		18	$9\frac{1}{4}$		46	28		48	564

Multiplying Compound Numbers. Suppose that a wholesaler ships walnuts in cases of $\frac{1}{2}$ doz. boxes, each box holding 4 lb. 9 oz. of walnuts. How many pounds are there in a case?

lb.	oz.
4	9
	6
27	6

Multiplying the ounces first, we have 54 oz., or 3 lb. 6 oz. We therefore write 6 under ounces. Then $6 \times 4 + 3 = 27$; that is, as here shown, there are 27 lb. 6 oz. of walnuts in each case.

In multiplying 243 ft. 7 in. by 27, however, it is easier not to reduce while multiplying, as we did above. That is, we first find 6561 ft. 189 in. as the result and then change to 6576 ft. 9 in., as shown at the right.

ft.	in.
243	7
	27
6561	189
6576	9

A clerk in a store would not multiply 5 lb. 4 oz. by 8, but would take

$$8 \times 5\tfrac{1}{4} \text{ lb.},$$

and similarly in most cases of this kind.

MULTIPLYING COMPOUND NUMBERS

1. Water weighs 62 lb. 8 oz. per cubic foot. What is the weight of water in a tank containing 375 cu. ft. of water?

2. The average height of the stories in an 8-story building is 11 ft. 9 in. What is the height of the building?

3. On a 6-day automobile trip a man uses an average of 9 gal. 3 qt. of gasoline a day. How much does he use in all?

4. Find the weight of cereal in a dozen packages, each of which contains 1 lb. 10 oz.

Dividing Compound Numbers. If a board 7 ft. 6 in. long is cut into two equal lengths to make a top for a work-bench, how long is each part?

First dividing the feet, the result is 3 with a remainder of 1 ft., or 12 in. Then adding this 12 in. to the 6 in. and dividing, the complete result is 3 ft. 9 in.

	ft.	in.
2)	7	6
	3	9

That is, each part is 3 ft. 9 in. in length.

A practical case in which we need to divide one compound number by another is rare. If, for example, we have to divide 41 ft. 3 in. by 2 ft. 9 in., we reduce both to feet ($41\frac{1}{4}$ ft. $\div$ $2\frac{3}{4}$ ft. $=$ 15) or to inches (495 in. $\div$ 33 in. $=$ 15).

DIVIDING COMPOUND NUMBERS

1. The perimeter of an equilateral (equal-sided) triangle is 17 ft. $9\frac{1}{2}$ in. Find the length of each side.

2. The perimeter of a square flower bed is 7 ft. 8 in. Find the length of each side.

3. An angle of $66° \, 44'$ is to be divided into 7 equal parts. How many degrees and minutes should each part contain?

4. If the school day is 5 hr. 45 min., how many hours, minutes, and seconds are there in half a school day?

5. At the rate of a mile in 4 min., how far will an automobile go in 1 hr.? in $2\frac{1}{2}$ hr.? in $4\frac{1}{4}$ hr.?

6. Traveling at the rate of a mile in 12 min., how far will a horse go in $2\frac{1}{2}$ hr.?

7. If the circumference of a wagon wheel is 10 ft. 6 in., how many times will the wheel turn in going 25 mi.?

Athletic Records. The table below compares various world records in amateur track and field events with performances in these events in recent meets:

EVENT	WORLD RECORD	RECENT MEETS
Walking, 3 mi.	20 min. 25.8 sec.	21 min. 50.1 sec.
Running, 100 yd.	9.6 sec.	10 sec.
Running, 220 yd.	20.8 sec.	22.1 sec.
Running, 1 mi.	4 min. 10.4 sec.	4 min. 17 sec.
Relay race, 1 mi.	3 min. 16.4 sec.	3 min. 21 sec.
Standing broad jump	11 ft. $4\frac{7}{8}$ in.	9 ft. $5\frac{1}{4}$ in.
Running broad jump	25 ft. 3 in.	24 ft. 6 in.
Hammer throw	189 ft. $6\frac{1}{2}$ in.	158 ft. $9\frac{3}{4}$ in.

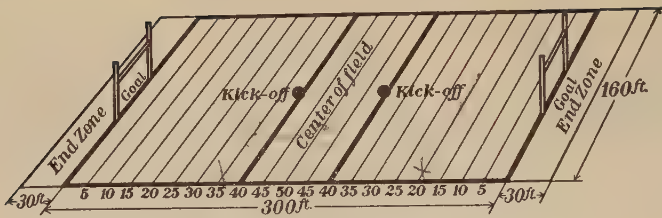
Many world records are held by American athletes.

ATHLETIC RECORDS

1. Find the difference between the world record and the time in recent meets for the 3-mile walking race.

2. As in Ex. 1, find the difference for each running race.

3. As in Ex. 1, find the difference in distance for each of the jumping events and for the hammer throw.



ATHLETIC FIELDS

1. Here is a plan of a football field. Not counting the 10-yard end zones, what is the length of the field in yards?

2. What is the width of the field in yards?

3. How many yards is it from each kick-off to the center of the field? to the nearer goal? to the other goal?

4. From its own 15-yard line a team advanced the ball in eight plays to the opponent's 10-yard line. What was the average distance gained in each play?

5. Standing on his own 20-yard line, a player made a kick of 45 yd. The ball was caught by the quarter back of the other team. On what line was he standing?

6. Not counting the two 10-yard end zones, what is the perimeter of the field in yards?

7. How many square yards are there in an acre?

8. If a football field contains 48,000 sq. ft., which has the greater number of square feet, the field or an acre, and what is the difference between them?

9. A double tennis court is 36 ft. wide and 78 ft. long. Draw a plan to the scale of 1 in. to 6 yd.

10. How many yards are there in the perimeter of the tennis court described in Ex. 9?

REVIEW OF MEASURES

Numbers 1 to 20, oral

Read the following, supplying the missing numbers:

1. 1 ft. = —— in.
2. $\frac{1}{2}$ ft. = —— in.
3. 3 ft. = —— in.
4. 3 ft. = —— yd.
5. 9 ft. = —— yd.
6. 1 rd. = —— ft.
7. 1 rd. = —— yd.
8. 2 yd. = —— ft.
9. 2 rd. = —— yd.
10. 2 rd. = —— ft.
11. —— yd. = 36 in.
12. —— yd. = 72 in.
13. —— yd. = 18 in.
14. —— yd. = 9 in.
15. 45 in. = —— yd.
16. 1 ft. 2 in. = —— in.
17. 1 yd. 2 in. = —— in.
18. 3 ft. 4 in. = —— in.
19. 1 yd. 4 in. = —— in.
20. 2 yd. 3 in. = —— in.

21. Express 1 sq. yd. as square inches.

22. A square is 2 ft. 3 in. on a side. How many feet are there in the perimeter? How many yards?

Copy, supplying the missing numbers:

23. $\frac{1}{4}$ lb. = —— oz.
24. $1\frac{1}{4}$ lb. = —— oz.
25. $\frac{1}{2}$ sq. yd. = —— sq. ft.
26. 3 sq. yd. = —— sq. ft.
27. 10 A. = —— sq. rd.
28. 1 sq. mi. = —— A.
29. 1 sq. ft. = —— sq. in.
30. 4 sq. yd. = —— sq. ft.
31. 9 T. = —— lb.
32. 9000 lb. = —— T.
33. 9 qt. = —— pt.
34. 9 gal. = —— qt.
35. 9 pk. = —— qt.
36. 9 bu. = —— pk.
37. 9 wk. = —— da.
38. 9 doz. = —— units.

WRITTEN REVIEW OF MEASURES

1. A schoolroom is 28 ft. long and 23 ft. wide. To decorate the room for the closing exercises, the class has to know the perimeter in yards. What is it?

2. Our school opens at 8 45 A.M. and has a recess at 10 30 A.M. How long is it from the opening to recess?

3. If a train leaves at 9 37 A.M. and the next stop is at 11 10 A.M., how long does it take to make the run?

4. If you need $44\frac{1}{2}$ in. of picture molding for your class picture and have a piece 4 ft. long, have you enough? Have you too much? How many inches more than enough or less than enough have you?

ft.	in.
13	8
	9

5. If the work shown at the right is an example in addition, what is the result?

6. If it is an example in subtraction, what is the result?

7. If it is an example in multiplication, what is the result? Check by division.

8. What is the perimeter of a square that is 2 ft. 6 in. on a side? of one that is twice as long on a side?

9. If each side of a triangle is 48 in., how many yards are there in the perimeter? how many feet? You may find the perimeter in inches and express the result in yards or feet, or you may express 48 in. as yards or feet and then find the perimeter. Which of these methods is the shorter?

10. Jack's birthday is March 8 and Mabel's is April 8. How many days are there from one date to the other?

SPEED TEST CHART IN MEASURES

Add as follows, recording the number of minutes:

	ft.	in.		yd.	in.		gal.	qt.		bu.	pk.
1.	2	3	**3.**	2	16	**5.**	12	3	**7.**	36	2
	4	11		3	9		16	2		27	

	ft.	in.		yd.	in.		gal.	qt.		hr.	min.
2.	3	9	**4.**	4	27	**6.**	16	3	**8.**	2	37
	5	2		3	32		12			3	12
	2	8		5	8		8			1	48

Subtract as follows, recording the number of minutes:

	ft.	in.		yd.	in.		gal.	qt.		bu.	pk.
9.	8	2	**11.**	4	2	**13.**	21	1	**15.**	12	2
	3	11		2	26		16	3		8	3

	ft.	in.		yd.	in.		gal.	qt.		hr.	min.
10.	6	0	**12.**	5	18	**14.**	30	0	**16.**	9	40
	2	8		1	32		12	2		2	10

Multiply as follows, recording the number of minutes:

17.	2 lb. 4 oz.	**18.**	2 ft. 4 in.	**19.**	2 hr. 4 min.
	5		5		5

Divide as follows, recording the number of minutes:

20. 3 ft. 4 in. by 2.

21. 3 yd. 4 in. by 2.

22. 3 hr. 4 min. by 2.

23. 2 lb. 1 oz. by 3.

24. 2 pk. 1 qt. by 3.

25. 2 gal. 1 qt. by 3.

MISCELLANEOUS PROBLEMS

1. A dealer marked down some collars from 30¢ each to 25¢ each. The lower price is what part of the higher price?

2. The amount of the reduction in Ex. 1 is what part of the higher price? what part of the lower price?

3. A dealer marked down some neckties from 3 for $2 to 60¢ each. The lower price is what part of the higher price?

4. After a man's salary was raised $\frac{1}{8}$, he received $2700 a year; that is, he received $\frac{9}{8}$ of what he received before. How much was his salary before it was raised?

5. The daily pay roll for 3600 men, who work in a certain factory, is $21,700. After deducting the amount paid to 100 men, who receive $7 each per day, find the average daily wage for the other men employed by the factory.

6. On a certain railroad, 2850 conductors received an increase in wages amounting to $4275 a day. What was the average daily increase per man?

7. A farmer shipped 800 barrels of apples to a city dealer. The dealer sold the apples for $4.40 a barrel, and charged the farmer 22¢ a barrel for selling, 8¢ a barrel for storage, $39.75 for freight, and $38.50 for cartage. How much did the farmer receive from the dealer?

8. When cotton was selling for 31¢ a pound, a dealer sold 175 bales, which weighed on the average 500 lb. each. Find the amount that the dealer received for the lot.

9. A man earns $7.25 a day, and works 6 da. a week. If during one week he pays $8.75 for groceries and $9.50 for rent, how much does he have left for other purposes?

III. PRACTICAL MEASUREMENTS

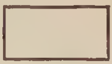
A SILENT READING LESSON

The denominate numbers, which we have been studying, do not mean much unless we know how to use them. We use such numbers in measuring. We know how to measure length, but we have not studied much about area.

We know that a *triangle* is a figure which has three sides. In problems we have often had to find the *perimeter;* that is, the distance around a triangle. We have also had to find the length of one side when we were given the perimeter and the lengths of the other two sides.


Triangle

We know about two kinds of four-sided figures, one of which is the *rectangle,* and the other the *square.* The four angles of a rectangle are all right angles. A square is a rectangle with all four sides equal.


Rectangle


Square

Another kind of four-sided figure is the *parallelogram.* It is formed by two pairs of parallel lines, which are lines that never meet. A rectangle is a kind of parallelogram; that is, it is one in which the angles are right angles.


Parallelogram

Still another kind of four-sided figure is called a *trapezoid.* In such a figure one pair of sides are parallel lines. In cities and towns not all the streets meet each other at right angles, and many house lots have the shape of a parallelogram or of a trapezoid. There are probably more, however, that have the shape of a rectangle or of a square.


Trapezoid

Triangles. The following figures show the kinds of common triangles about which we need to know:

Equilateral Isosceles Right Acute Obtuse

Practice drawing these triangles on the board and on paper until you know them well. Ask your teacher to explain the names if you cannot tell what they mean from the figures.

A LITTLE WRITING LESSON

Copy and complete the following statements:

1. A triangle has —— sides and —— angles.

2. An *equilateral* triangle has all its sides ——.

3. An *isosceles* triangle has —— of its sides equal.

4. A *right* triangle has one —— angle.

5. An *acute* triangle has all its —— acute.

6. An *obtuse* triangle has one of its —— obtuse.

7. If you add all the —— of a figure, the result is called the perimeter of the ——.

8. If one side of an equilateral triangle is 2 in., the —— of the triangle is 6 in.

9. If one side of an isosceles triangle is 2 in. and another is 3 in., the third —— is either —— in. or —— in.

10. A right triangle can also be an isosceles ——, but it cannot be an —— triangle, an —— triangle, or an —— triangle.

Base and Height. The line on which a figure appears to stand is called the *base*. The distance from the highest point to the base is called the *height* or *altitude*.

Area of a Rectangle. A school building has an entrance hall 10 ft. long and 4 ft. wide. The floor is made of marble squares 1 ft. on each side, as shown in this figure.

How many squares are there in each row? How many rows are there? We thus see that there are 4×10, or 40, squares in the floor. Since each square has an area of 1 sq. ft., we see that the area of the floor is 40 sq. ft. That is,

The area of a rectangle is the product of the base and height.

In using this rule, we do not multiply 10 ft. by 4 ft., but say that $4 \times 10 = 40$, the *number* of square feet, and write 4×10 sq. ft. = 40 sq. ft.

AREA OF A RECTANGLE

Using short methods, find the area of a rectangle which is

1. 3 in. by $6\frac{1}{2}$ in.
2. 5 in. by $7\frac{1}{4}$ in.
3. 8 in. by $9\frac{7}{8}$ in.
4. 9 in. by $9\frac{1}{4}$ in.
5. 38 ft. by 46 ft.
6. $33\frac{1}{3}$ yd. by 60 yd.
7. 75 ft. by 96 ft.
8. $66\frac{2}{3}$ yd. by 66 yd.
9. 65 ft. by 75 ft.
10. 25 ft. by 46 ft.
11. 62 ft. by 84 ft.
12. $87\frac{1}{2}$ in. by 88 in.
13. Measure your blackboards and find the area of each.

SCHOOL-AND-HOME PROJECTS

1. The school-and-home project in one school district was gardening; that is, each pupil cultivated a piece of land, kept track of the expenses, and reported the profit. A garden that is 8 rd. long and 2 rd. wide contains what part of an acre?

2. A pupil who cultivated a piece of land 10 rd. long and 4 rd. wide was cultivating what part of an acre?

3. Frank cultivated a garden 5 rd. long and $2\frac{1}{2}$ rd. wide. He put a fence around it, using four wires nailed to posts. If a spool of 330 yd. of wire cost $4, find the cost of the wire used in building the fence.

4. Richard Heath measured his piece of land, and found it to be 44 ft. wide and 66 ft. long. He said that it contained a little over $10\frac{1}{2}$ sq. rd. Was he right? How much over $10\frac{1}{2}$ sq. rd. was there in the piece of land?

5. On the piece of land described in Ex. 4, Richard raised 36 pk. of potatoes. Find to the nearest peck the amount of potatoes that he raised per square rod.

6. At the number of pecks per square rod found in Ex. 5, how many bushels should Richard raise per acre?

7. Richard sold the potatoes mentioned in Ex. 5 at $1.30 a bushel. How much money did he receive?

8. The storekeeper to whom Richard sold his potatoes sold them at 5¢ a pound. There are 60 lb. of potatoes in a bushel. How much did the storekeeper receive for 1 bu.? for all the potatoes? Disregarding the expenses of running his store, how much did he make in all?

USING SCALE DRAWINGS

1. The figure below shows the plan of a small apartment, drawn to the scale of 1 in. to 10 ft. You have already learned that the scale of 1 in. to 10 ft. means that we use 1 in. to represent 10 ft. The scale $\frac{1}{12}$ means that 1 in. represents 12 in. Express the scale of this plan as a fraction.

2. What is the width of the windows in the living room?

3. What is the area of the floor of the living room?

4. Measure the plan and find the size of the inner hall into which the bedrooms and the living room open.

5. What is the area of the floor of the kitchen?

6. What is the area of the floor of each bedroom?

7. What is the total floor space in the apartment, not counting the closets and bathroom?

DRAWING TO SCALE

1. The boys are making a book cover which is to be 6 in. by 9 in. Using the scale $\frac{1}{2}$, draw a plan of the cover.

2. A school corridor is 8 ft. by 80 ft. Draw a floor plan of the corridor, using the scale of $\frac{1}{16}$ in. to 1 ft.

3. A playground is 64 ft. by 96 ft. Draw a plan of the playground, using the scale of $\frac{1}{16}$ in. to 1 ft.

4. A schoolroom is 30 ft. long and 25 ft. wide. Draw a plan of the floor, using the scale of $\frac{1}{8}$ in. to 1 ft.

5. Draw a plan of a floor 24 ft. long and 16 ft. wide, using the scale of $\frac{1}{8}$ in. to 1 ft.

6. Draw a plan of a school garden 64 ft. long by 40 ft. wide to the scale of $\frac{1}{8}$ in. to 1 ft.

7. Draw a plan of a mat 16 in. by 28 in. to the scale $\frac{1}{4}$.

8. A plan for a rectangular playhouse is drawn to the scale of 1 in. to 2.5 ft. The plan is 6.4 in. long and 4 in. wide. Find the area of the playhouse floor.

9. The class has made a floor plan of a rectangular room. The drawing has an area of 20 sq. in. If a scale twice as large were used, what would be the area of the drawing? Draw two rectangles which show that your answer is correct.

10. Measure the top of your desk to the nearest inch. Make a drawing of the top, as you look at it from above, using the scale $\frac{1}{8}$.

11. Make two plans of the blackboard, one to the scale of $\frac{1}{4}$ in. to 1 ft. and the other to the scale of $\frac{1}{8}$ in. to 1 ft.

SIDES AND PERIMETERS

1. What is the perimeter of an equilateral triangle that is 19 ft. 7 in. on a side? Draw neat figures in all the work on this page, but you need not make them to scale.

2. A triangle has a perimeter of 114 ft. 2 in. One side is 30 ft., and another is half as long again. How long is the third side of the triangle?

3. The base of an isosceles triangle is 25 ft., and each of the equal sides is $\frac{1}{5}$ longer. How long is the perimeter?

4. Draw a triangle, cut off the three angles, and place them on a line, the angles meeting at one point. Do you find that they equal two right angles? Try this with several triangles of different shapes.

Find the sides of equilateral triangles with perimeters of

5. 113 ft. 3 in.   6. 127 yd.   7. 88 ft. 3 in.

Find the sides of squares with perimeters of

8. 110 ft. 4 in.   10. 61 yd. 2 ft.   12. 118 ft. 8 in.

9. 42 ft. $3\frac{1}{2}$ in.   11. 2 ft. 4 in.   13. 227 mi. 40 rd.

14. The perimeter of an isosceles triangle is 100 ft., and the unequal side is 33 ft. long. Find the length of one of the equal sides.

15. The perimeter of an isosceles triangle is 88 ft., and the unequal side is $\frac{1}{5}$ of the perimeter. Find the sides.

16. The perimeter of a triangle is 24 ft. One side is $\frac{1}{3}$ of the perimeter, and another is $\frac{3}{8}$ of the perimeter. How many feet are there in each of the three sides?

MEASUREMENTS IN GARDENING

1. In order to earn money for their summer-camp expenses, some boys rented a piece of land 40 rd. long and 20 rd. wide. At $10 an acre, how much was the rent?

2. The length of the field in Ex. 1 ran north and south. Starting from the northwest corner, the boys planted early potatoes in a strip 4 rd. wide the entire length of the field. How many acres of early potatoes did they plant?

3. Adjoining the strip in Ex. 2, they laid out, lengthwise of the field, a strip 6 rd. wide. They planted early sweet corn in the northern quarter of it. What part of an acre did they plant to early sweet corn?

4. They planted the rest of the strip in Ex. 3 to a later variety of corn. How many acres of this did they plant?

5. Make a plan of the field to the scale of $\frac{1}{8}$ in. to 1 rd., putting in all the measurements and the areas of the various pieces, and show on the plan what was planted in each one of the strips.

6. They planted the strip of early corn in Ex. 3 in rows 3 ft. 2 in. apart, the rows running north and south. The first and last rows were each 2 ft. from the edges of the strip. They planted the corn in hills 2 ft. 9 in. apart, leaving a space equal to the distance between the hills at each end of the strip. How many hills did they plant?

7. The hills in the strip of early corn produced an average of three ears per hill. If the boys sold it at 20¢ per dozen, how much did they receive for this corn?

8. The boys planted late potatoes in a strip $115\frac{1}{2}$ ft. wide the entire length of the field, and planted sugar beets on the rest of the piece of land. How many acres did they plant to each of these crops? Complete the plan in Ex. 5, and check the areas of the different strips by adding them together and comparing the result with the number of acres which you found in Ex. 1.

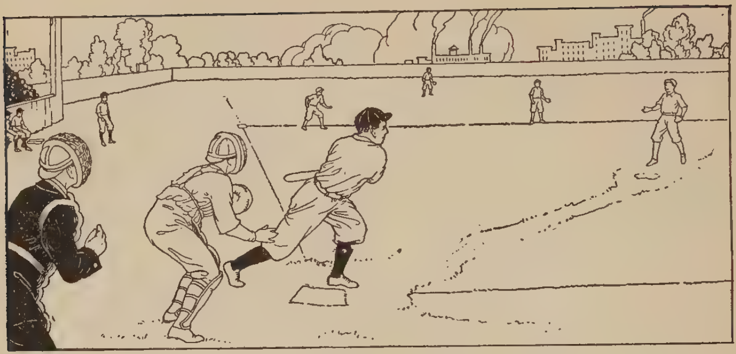
9. It takes 7 bu. of seed potatoes to plant an acre. If seed potatoes cost $3.20 per 100 lb., and 1 bu. weighs 60 lb., how much did the boys pay for the seed potatoes in Ex. 8?

10. The strip of late potatoes in Ex. 8 yielded 3 pk. to each square rod of land, and the boys sold the potatoes for $1.50 per 100 lb. Taking the weight of 1 bu. as 60 lb., how much did they receive for their crop of potatoes?

11. Land such as was used for the sugar beets in Ex. 8 yields 18 T. per acre, and the crop is worth $10 per ton. The expenses per acre of raising sugar beets are as follows: rent, $10; seed, 12 lb. at 70¢ per pound; labor, $21. Find the profit the boys should make on their crop of beets.

12. The farmer whose land adjoined the field the boys rented was careless. He planted $82\frac{1}{2}$ A. of corn without giving the seed an ear-to-ear test, the result being that four ears out of every bushel of seed corn failed to grow. If we estimate 100 ears of seed corn to a bushel, and if the yield was 50 bu. to the acre, what was the farmer's loss, at 75¢ per bushel, from failing to test the seed?

13. If the work of testing the seed corn in Ex. 12 would have taken 5 da., what wages per day would the increased yield of corn have paid the farmer?



THE ATHLETIC FIELD

1. The infield of a baseball diamond is a square 90 ft. on a side. Draw a plan to the scale of 1 in. to 20 ft.

2. In the infield, the pitcher's box is $60\frac{1}{2}$ ft. from home plate, measured on a line between home plate and second base. Draw another plan of the infield, using the scale of $\frac{1}{16}$ in. to 1 ft., and mark the position of the pitcher's box.

3. There is a batter's box on each side of home plate. The boxes, which are 29 in. apart, are rectangles 6 ft. long and 4 ft. wide, with the center of the long side almost opposite the center of home plate. Show the batters' boxes on the plan of Ex. 2.

4. A school rents a piece of land 30 rd. wide and 40 rd. long for a baseball and football field. How many acres are there in the field?

5. Draw a plan of the field of Ex. 4 to the scale of 1 in. to 100 ft. and place the baseball diamond, drawn to the same scale, in what you think is the best place.

OUTDOOR MEASUREMENTS

1. Near the school some surveyors were laying out house lots on a tract of land. One of the lots was 70 ft. 6 in. along the front and 106 ft. 6 in. in depth. The class found that the area of this lot was —— sq. ft.

2. The class found that it would take —— ft. of fence to inclose the lot in Ex. 1.

3. The boys paced off 36 steps of 27 in. each along the front of the next lot. They found that the frontage of this lot was —— ft.

4. The class measured the distances between the stakes for a cellar and found that it was to be 22 ft. 6 in. by 34 ft. 6 in. The area of the cellar was to be —— sq. ft.

5. From the corner of the cellar nearest to a fire hydrant the boys paced off 256 steps of 27 in. each. The house was to be —— ft. from the hydrant.

6. Measure the length of your ordinary step and learn to pace short distances.

Area of a Parallelogram. If we cut off the triangle T from this parallelogram and place it in the position shown by X, what kind of figure do we have then?

How does this figure tell us that the area of a parallelogram is equal to the area of a rectangle with the same base and the same height? We thus have the following rule:

The area of a parallelogram is the product of the base and height.

AREA OF A PARALLELOGRAM

1. On paper draw and cut out three parallelograms with different bases and heights. Show that each parallelogram can be made into a rectangle with the same area.

2. To the scale $\frac{1}{4}$, draw a parallelogram in which the base is 12 in. and the height is 6 in.

Find the areas of parallelograms or of rectangles which have the following bases and heights:

3. 14 in., 12 in.
5. 24 ft., $18\frac{1}{2}$ ft.
7. 52 ft., $32\frac{1}{2}$ ft.
4. 28 ft., 18 ft.
6. $4\frac{1}{4}$ in., $3\frac{1}{2}$ in.
8. 8 yd., $14\frac{1}{2}$ yd.

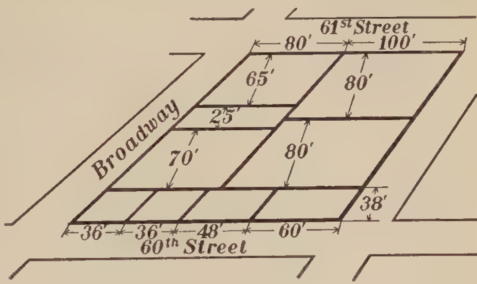
9. A woman cuts a piece of velvet on the bias, thus cutting off a parallelogram with a base of 28 in. and a height of 9 in. How many square inches are cut off?

Find the areas of parallelograms or of rectangles which have the following bases and heights:

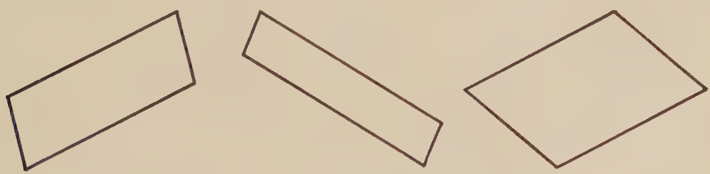
10. 8.7 in., 7.9 in.
12. 27 ft. 9 in., 1 yd.
11. 32 ft., $27\frac{1}{2}$ ft.
13. 8 ft. 6 in., 7 ft. 8 in.

14. This figure shows a plan of the lots in a block on Broadway, between 60th St. and 61st St. Each lot has the form of a parallelogram. Find the area of each of the nine lots.

15. Check your work in Ex. 14 by finding the area of the entire block and showing that this result is the same as the total area of the nine lots.



16. What is the area of a parallelogram with a base of 180 ft. and a height of 38 ft.? Show that this result equals that of adding the areas of the lots on 60th St. in Ex. 14.



17. These three figures are drawn to the scale of $\frac{1}{8}$ in. to 10 ft. Find in square feet the area of the parallelogram represented by each figure. In measuring the heights, place the ruler at right angles to the longer sides.

18. A school playground in the shape of a parallelogram is 180 ft. along the long sides and 75 ft. straight across between them. Draw a plan to scale, and find the area of the playground.

AREA OF A TRIANGLE

All work oral

1. How is the area of a parallelogram found?

2. In this parallelogram, how does the area of the triangle indicated by the heavy lines compare with that of the other triangle? A triangle is what part of a parallelogram with the same base and the same height?

3. If the base in Ex. 2 is 6 in., and the height is 3 in., what is the area of the parallelogram? of each triangle?

4. In this parallelogram, how do the areas of the two triangles compare? Each of the triangles is what part of the parallelogram?

5. In the rectangle here shown, how does the area of the triangle indicated by the heavy lines compare with the area of the other triangle? A triangle is what part of a rectangle of the same base and the same height?

6. If the rectangle in Ex. 5 is 10 ft. wide and 5 ft. high, what is its area? What is the area of each of the triangles?

7. If you wish to find the area of some triangular piece of ground, what measurements shall you take?

Find the areas of triangles with bases and heights as follows:

8. 5 in., 4 in.

9. 7 in., 6 in.

10. 6 in., 4 in.

11. 8 in., 6 in.

12. 9 in., 10 in.

13. 10 ft., 20 ft.

Area of a Triangle. From page 282 we have this rule:

The area of a triangle is half the product of the base and height.

Thus, in finding the area of a triangle with a base of 18 in. and a height of 7 in., we have

$\frac{1}{2}$ of 18×7 sq. in.

We arrange the work as shown at the right, cancel, and find the result to be 63; that is, the area is 63 sq. in.

$$\boxed{\frac{\overset{9}{\cancel{18}} \times 7}{\cancel{2}} = 63}$$

AREA OF A TRIANGLE

Numbers 1 to 6, oral

State the areas of triangles with bases and heights as follows:

1. 40 in., 25 in. **3.** 90 in., $33\frac{1}{3}$ in. **5.** 64 in., 50 in.

2. 160 ft., 125 ft. **4.** 160 in., 25 in. **6.** 60 in., $16\frac{2}{3}$ in.

Find the areas of triangles with bases and heights as follows:

7. 27.9 in., 18.7 in. **10.** $36\frac{1}{4}$ ft., $44\frac{1}{2}$ ft.

8. 28.7 in., 36.3 in. **11.** 4 ft. 8 in., 3 ft. 6 in.

9. 25.2 in., 19.4 in. **12.** 3 ft. $4\frac{1}{2}$ in., 2 ft. $6\frac{1}{2}$ in.

13. What is the area of an equilateral triangular flower bed with a perimeter of 36 ft. and a height of 10.4 ft.?

14. What is the area of a triangular lot which has a height of 6.4 rd. and a base of 17 rd.?

15. In a field in the shape of a right triangle the sides of the right angle are 30 rd. and 40 rd. Find the area.

HOME, SCHOOL, AND OUTDOOR WORK

1. Bring to class tomorrow three examples of measurements which you have made or which have been made in your home or your school when buying or making articles. If you are doing work in domestic science or in manual training, you may find some good examples there.

2. Tell the class tomorrow about the shape of one of the best-kept lots near the school. Tell how you would go to work to measure in order to find the area of the sidewalk, the area of the lot, and the area covered by the house. Tell why it is one of the best-looking lots near the school.

3. How should you find the area of the school lot? of your schoolroom? of the ground covered by the school building? If the teacher so directs, make the actual measurements to the nearest foot.

4. Draw the schoolroom floor to scale, using $\frac{1}{4}$ in. to 1 ft. Divide it into square feet, like the figure on page 271. See how much easier it is to find the number of squares by multiplying than by counting, and give the area of the floor in square feet.

5. Draw the school lot to scale, using $\frac{1}{8}$ in. to 10 ft. Find the area in square feet; in square yards.

6. Making your measurements only to the nearest inch, draw the top of your desk to scale, using 1 in. to 8 in. What is the area of the top of the desk?

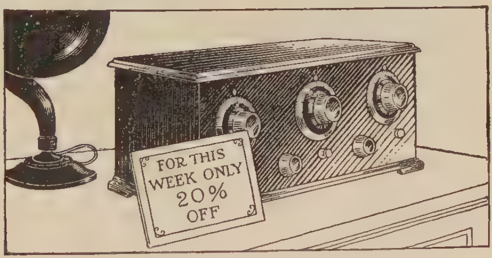
7. A line from one corner of your desk to the opposite corner would divide the top into two triangles. What would be the area of each triangle?

IV. INTRODUCTION TO PERCENTAGE

A SILENT READING LESSON

The captain of the sixth-grade baseball team found that he could buy a catcher's mitt for $2. The clerk told him that if he could wait until the next day, these mitts would be marked down 10 per cent. The captain had to ask the clerk what this meant. From this we see that we ought to know what "per cent" means.

A radio set was advertised before the Christmas holidays at $65. After the holiday business, it could be bought at "20 per cent off." If we were buying a radio set, it would be worth something to us to know what is meant by the expression "20 per cent off."



In the newspaper Tom's mother saw an advertisement of a sale of boys' suits. The regular price of the suits was $15, but they were being marked down 20 per cent. If she buys Tom a suit, she needs to know what the advertisement means.

In making a report of the number of pupils tardy or absent last week, the teacher said that 5 per cent of the pupils had been tardy and that 2 per cent had been absent. We ought to know what this statement means.

Per cents are frequently used, and we ought to know what they mean.

Per Cent. Another name for "hundredths" is *per cent.* Thus, instead of saying "ten hundredths" we may, if we wish, say "ten per cent." The two expressions have the same meaning.

When the captain of the baseball team found that catchers' mitts which cost $2 were to be marked down 10 per cent, it meant that a mitt could be bought for $\frac{10}{100}$, or $\frac{1}{10}$, less than $2; that is, for $2 – $0.20, or $1.80.

We use the symbol % instead of the words "per cent." For example, we write **40%** for "40 per cent," or "0.40."

Hundredths as Per Cents. Because hundredths and per cents are the same, any fraction with the denominator 100 may be written with the symbol %. For example,

$$\frac{45}{100} = 0.45 = 45\% \text{ and } \frac{235}{100} = 2.35 = 235\%$$

READING PER CENTS

All work oral

Read the following numbers as per cents:

1. $\frac{3}{100}$.	**4.** $\frac{8}{100}$.	**7.** $\frac{28}{100}$.	**10.** 0.50.	**13.** 0.82.
2. $\frac{5}{100}$.	**5.** $\frac{10}{100}$.	**8.** $\frac{37}{100}$.	**11.** 0.65.	**14.** 0.95.
3. $\frac{6}{100}$.	**6.** $\frac{18}{100}$.	**9.** $\frac{44}{100}$.	**12.** 0.75.	**15.** 1.00.

Read the following per cents as hundredths:

16. 10%.	**18.** 38%.	**20.** 60%.	**22.** 82%.	**24.** 200%.
17. 30%.	**19.** 45%.	**21.** 75%.	**23.** 98%.	**25.** 300%.

26. Read as per cents: $\frac{12\frac{1}{2}}{100}$, $\frac{62\frac{1}{2}}{100}$, $\frac{\frac{1}{4}}{100}$, $\frac{33\frac{1}{3}}{100}$, $\frac{\frac{1}{8}}{100}$, $\frac{66\frac{2}{3}}{100}$.

Halves and Fourths as Per Cents. Mr. Sinclair sold an automobile for 50% of its cost. What does this mean? He sold the car for how many hundredths of what it had cost him? Express this as a fraction in lowest terms.

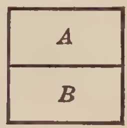
If a baseball team played 48 games and lost 25% of them, how many games were lost? How many hundredths of the games were lost? How many fourths?

We thus see that $50\% = \frac{50}{100} = \frac{1}{2}$, and $25\% = \frac{25}{100} = \frac{1}{4}$.

HALVES AND FOURTHS AS PER CENTS

All work oral

1. If this square represents a floor containing 100 sq. ft., how many square feet are there in the part marked *B*? Then *B* is how many hundredths of the square? What per cent of the square is *B*? Then *A* is what per cent of the square?



2. If asked to find 50% of a number, what fraction of the number may you find instead? Give an example to illustrate your answer.

Find 50% of each of the following numbers:

3. 30. **4.** 36. **5.** 48. **6.** 60. **7.** 300.

8. If this square represents a box cover containing 100 sq. in., how many fourths are shaded? How many hundredths are shaded? What per cent is shaded?

Find 25% of each of the following numbers:

9. 16. **11.** 40. **13.** 48. **15.** 72. **17.** 400. **19.** 4000.
10. 36. **12.** 44. **14.** 60. **16.** 80. **18.** 800. **20.** 8000.

Important Per Cents. If the sixth-grade team plays 8 games and loses 50% of them, how many does it lose?

If it loses 25%, how many games does it lose?

How much is $\frac{1}{2}$ of 25? $\frac{1}{2}$ of 25%? If the team loses $12\frac{1}{2}$% of 8 games, how many games does it lose?

It is important that we should know that

$\frac{1}{2} = 0.50 = 50\%$ $\frac{1}{4} = 0.25 = 25\%$ $\frac{1}{8} = 0.12\frac{1}{2} = 12\frac{1}{2}\%$

HALVES, FOURTHS, AND EIGHTHS

1. A school has 284 pupils, and 50% of them are girls. How many girls are there in the school?

2. A boy had 68 marbles and lost 25% of them. How many did he lose, and how many did he have left?

3. Fred made 48 runs in this year's games, and Jack made $12\frac{1}{2}$% more. How many runs did Jack make?

4. A school has 488 pupils, and $12\frac{1}{2}$% were tardy last week. How many were tardy?

5. A farmer sold $12\frac{1}{2}$% of the 104 sheep which he owned. How many sheep were sold?

Find the value in each of the following cases:

6. 50% of 2078.
7. 25% of 3572.
8. 50% of 16,390.
9. 25% of $4416.72.
10. 50% of 1276 bu.
11. 25% of 84 ft. 4 in.
12. $12\frac{1}{2}$% of $99.28.
13. $12\frac{1}{2}$% of $97.76.

14. A man owned 128 A. of land and sold $12\frac{1}{2}$% of it at $125 an acre. How many acres did he sell? How much did he receive for what he sold?

Other Important Per Cents. When handkerchiefs are marked down $33\frac{1}{3}\%$ at a bargain sale, what fraction are they marked down?

How much is $\frac{1}{3}$ of 100? How much is $\frac{2}{3}$ of 100?

How much is $\frac{1}{2}$ of $\frac{1}{3}$? How much is $\frac{1}{6}$ of 100?

It is important that we should know that

$$\frac{1}{6} = 0.16\frac{2}{3} = 16\frac{2}{3}\% \qquad \frac{1}{3} = 0.33\frac{1}{3} = 33\frac{1}{3}\%$$

$$\frac{2}{3} = 0.66\frac{2}{3} = 66\frac{2}{3}\%$$

THIRDS AND SIXTHS

1. If circle A is called 100, how much is the shaded part? The shaded part is what per cent of the circle?

2. Read $0.33\frac{1}{3}$, using the words "per cent"; using the word "hundredths." How many thirds are there in 1? How many times is $33\frac{1}{3}\%$ contained in 1?

A

3. If circle B is called 100, the shaded part is what part of $33\frac{1}{3}$? How much is this? Then the shaded part is what per cent of the circle?

B

4. If circle C is called 100, the shaded part is what part of $16\frac{2}{3}$? How much is this? Then the shaded part of the circle is what per cent of the whole circle? Then $\frac{1}{12}$ is what per cent?

C

Find the value in each of the following cases:

5. $33\frac{1}{3}\%$ of 894.
6. $66\frac{2}{3}\%$ of \$3714.30.
7. $16\frac{2}{3}\%$ of \$1234.56.
8. $66\frac{2}{3}\%$ of 1047 yd.
9. $16\frac{2}{3}\%$ of 7386 bu.
10. $33\frac{1}{3}\%$ of 6528 mi.

Other Important Per Cents. We should also know that

$20\% = \frac{1}{5}$	$60\% = \frac{3}{5}$	$75\% = \frac{3}{4}$	$62\frac{1}{2}\% = \frac{5}{8}$
$40\% = \frac{2}{5}$	$80\% = \frac{4}{5}$	$37\frac{1}{2}\% = \frac{3}{8}$	$87\frac{1}{2}\% = \frac{7}{8}$

Study all these until you know them perfectly.

IMPORTANT PER CENTS

Numbers 1 to 9, oral

1. In a school of 465 pupils 20% of them are in the sixth grade. How many are in this grade?

2. After you have completed $37\frac{1}{2}\%$ of an automobile trip of 320 mi., how far have you gone?

3. In a school of 500 pupils 60% are in the first four grades. How many pupils are in those grades?

Find the value in each of the following cases:

4. 20% of 45. **6.** 60% of 50. **8.** 75% of 400.

5. 40% of 35. **7.** 80% of 50. **9.** $87\frac{1}{2}\%$ of 1600.

10. After finishing $37\frac{1}{2}\%$ of a railroad journey of 344 mi., how many miles have you gone?

11. A contractor has completed $62\frac{1}{2}\%$ of a job for which he is to receive $2720. If he is paid for the work completed, how much does he receive?

Find the value in each of the following cases:

12. $12\frac{1}{2}\%$ of 320 ft. **15.** 10% of 10%.

13. $37\frac{1}{2}\%$ of 248 mi. **16.** 20% of $62\frac{1}{2}\%$.

14. $62\frac{1}{2}\%$ of 360 ft. **17.** 40% of $87\frac{1}{2}\%$.

ORAL DRILL CHART IN PER CENTS

State the value rapidly in each of the following cases:

1. $\frac{1}{4}$ of 20.	8. $87\frac{1}{2}\%$ of 80.	15. $66\frac{2}{3}\%$ of 30.
2. 25% of 20.	9. $12\frac{1}{2}\%$ of 16.	16. $\frac{1}{5}$ of 150.
3. 25% of 32.	10. 25% of 16.	17. 20% of 150.
4. $\frac{1}{8}$ of 32.	11. $37\frac{1}{2}\%$ of 16.	18. $\frac{2}{5}$ of 50.
5. $12\frac{1}{2}\%$ of 32.	12. 50% of 16.	19. 40% of 50.
6. $12\frac{1}{2}\%$ of 48.	13. $62\frac{1}{2}\%$ of 16.	20. 60% of 50.
7. $37\frac{1}{2}\%$ of 48.	14. $87\frac{1}{2}\%$ of 16.	21. 80% of 50.

Read the following, supplying the missing numbers:

22. $\frac{1}{4}$ of 16 = ——.	35. $\frac{1}{8}$ of 160 = ——.
23. $\frac{1}{4}$ of —— = 10.	36. $\frac{1}{8}$ of —— = 10.
24. —— of 16 = 4.	37. 50% of —— = 50.
25. —— of 16 = 2.	38. ——% of 400 = 200.
26. 25% of 40 = ——.	39. ——% of 400 = 100.
27. ——% of 40 = 4.	40. $12\frac{1}{2}\%$ of 24 = ——.
28. ——% of 44 = 11.	41. $12\frac{1}{2}\%$ of —— = 5.
29. ——% of 40 = 20.	42. $\frac{3}{4}$ of 40 = ——.
30. $\frac{1}{2}$ of 24 = ——.	43. 75% of 40 = ——.
31. 50% of —— = 12.	44. ——% of 80 = 20.
32. $\frac{1}{2}$ of 100 = ——.	45. ——% of 80 = 60.
33. $\frac{1}{2}$ of —— = 100.	46. 100% of 37 = ——.
34. 50% of 200 = ——.	47. 100% of —— = 29.

WRITTEN REVIEW OF PER CENTS

Find the value in each of the following cases:

1. $\frac{1}{2}$ of \$4800.
2. 50% of \$4800.
3. $\frac{1}{4}$ of \$120.
4. 25% of \$120.
5. 25% of \$125.
6. 25% of \$125.40.
7. 75% of \$125.40.
8. $\frac{1}{3}$ of \$4200.
9. $33\frac{1}{3}$% of \$4500.
10. $\frac{1}{8}$ of \$1680.
11. $12\frac{1}{2}$% of \$1688.16.
12. $37\frac{1}{2}$% of \$1688.16.
13. $62\frac{1}{2}$% of \$3208.64.
14. $87\frac{1}{2}$% of \$3208.64.

15. 25% of \$172.80 is \$4.32, \$43.20, \$4320, or \$432. Which one is it?

16. 25% of \$3364.40 is \$1345.76, \$1682.20, \$841.10, or \$168.22. Which one is it?

17. Is $33\frac{1}{3}$% of \$1575.30 equal to \$51.41, \$50.51, or \$52.51? If it is not equal to any of these, what change in the decimal point would make one of them correct, and which one is it?

18. A dealer told me that I could buy a coat for 75% of the regular price. If the regular price was \$36, what would the coat cost me?

19. If a dealer told me that I could buy a coat for \$15, and that this price was 50% of the regular price, what was the regular price of the coat?

20. If you buy a baseball from Ben for 50¢, which is 50% of what he paid for it, how much did Ben pay? How much less does Ben receive than he paid?

Per Cents and Fractions. Since per cent means hundredths, we may write

$$62\tfrac{1}{2}\% = \frac{62\frac{1}{2}}{100} = \frac{\frac{125}{2}}{100} = \frac{125}{200} = \frac{5}{8}.$$

To express a per cent as a fraction, write the number indicating the per cent as the numerator and 100 as the denominator, and reduce to lowest terms.

In multiplying by 13%, it is easier to use 0.13; but in multiplying by $33\frac{1}{3}\%$, it is easier to use $\frac{1}{3}$.

We know that $\frac{2}{3}$ may be reduced to hundredths by multiplying each term by $33\frac{1}{3}$. We then have

$$\frac{2}{3} = \frac{66\frac{2}{3}}{100} = 66\tfrac{2}{3}\%.$$

To express a fraction as per cent, change to hundredths and then write the numerator and the symbol %.

We may also divide the numerator by the denominator, as in

$$\tfrac{2}{3} = 2.00 \div 3 = 0.66\tfrac{2}{3} = 66\tfrac{2}{3}\%.$$

PER CENTS AND FRACTIONS

Express as fractions in lowest terms:

1. 36%. **3.** 25%. **5.** 30%. **7.** 18%. **9.** $82\frac{1}{2}\%$.

2. 64%. **4.** $6\frac{1}{4}\%$. **6.** 125%. **8.** 375%. **10.** $33.3\frac{1}{3}\%$.

Express each of the following numbers as per cents:

11. $\frac{3}{8}$. **13.** $\frac{7}{8}$. **15.** $\frac{2}{5}$. **17.** $\frac{4}{5}$. **19.** $\frac{3}{16}$. **21.** 1.

12. $\frac{5}{8}$. **14.** $\frac{1}{5}$. **16.** $\frac{3}{5}$. **18.** $\frac{1}{16}$. **20.** $\frac{17}{16}$. **22.** $3\frac{1}{2}$.

FRACTIONS, DECIMALS, AND PER CENTS

1. If you are asked to find 25% of a number, should you multiply by 0.25, or should you divide by 4? Why will the two results be the same? Which is the easier method?

2. If you are asked to find 50% of a number, what is the easiest way of proceeding? Illustrate your answer by finding 50% of \$480.

3. If you are asked to find 75% of a number, how should you proceed? Is this the easiest way? Illustrate your answer by finding 75% of \$240.

Copy the following tables, filling all the blank spaces:

	Fraction	Decimal	Per Cent
4.	$\frac{1}{2}$	0.50	50%
5.	$\frac{1}{4}$		
6.		0.75	
7.			$12\frac{1}{2}$%
8.	$\frac{3}{8}$		
9.		$0.62\frac{1}{2}$	
10.			$87\frac{1}{2}$%

	Fraction	Decimal	Per Cent
11.	$\frac{1}{3}$		
12.		$0.66\frac{2}{3}$	
13.			20%
14.		0.30	
15.	$\frac{2}{5}$		
16.		$0.16\frac{2}{3}$	
17.			$83\frac{1}{3}$%

18. What is the shortest way of finding $\frac{1}{100}$ of a number? 1% of a number? 0.01 of a number? Illustrate by taking these parts of 125.

19. What is the shortest way of finding $\frac{1}{100}$ of 112? of finding $\frac{2}{100}$ of 112? of finding 3% of 112?

A SILENT READING LESSON

That part of arithmetic which relates to per cents is called *percentage*. In school, the word "percentage" is sometimes used to mean a per cent of a number.

For example, 10% of $200 is $20, and the $20 is sometimes called the percentage, but not by business men.

Suppose that the regular price of a dress that Mary wishes to buy is $16, but tomorrow it is to be marked down 15%. To find how much the dress will cost Mary, we must find a per cent of a number.

$$\begin{array}{r} \$16 \\ 0.15 \\ \hline 80 \\ 16 \\ \hline \$2.40 \end{array} \qquad \begin{array}{r} \$16.00 \\ 2.40 \\ \hline \$13.60 \end{array}$$

Since 15% = 0.15, we multiply as here shown, and find that the dress is to be marked down $2.40.

Subtracting $2.40 from $16, we have $13.60, the cost of the dress.

In finding a per cent of a number, express the per cent as a decimal and multiply the number by this decimal.

John finds that a camping suit, originally costing $12, has been marked down $12\frac{1}{2}\%$. In finding $12\frac{1}{2}\%$ of $12, John sees that it is easier to take $\frac{1}{8}$ of $12 than $0.12\frac{1}{2} \times \$12$.

That is, the suit has been marked down $1.50 and will therefore cost John

$12.00 – $1.50, or $10.50.

$$\begin{array}{r} \$1.50 \\ 8\overline{)\$12.00} \end{array} \qquad \begin{array}{r} \$12.00 \\ 1.50 \\ \hline \$10.50 \end{array}$$

If we wish to find 50%, 25%, $12\frac{1}{2}\%$, $16\frac{2}{3}\%$, $33\frac{1}{3}\%$, or $66\frac{2}{3}\%$ of a number, it is easier to use a fraction. By so doing we can frequently do the work mentally.

FINDING PER CENTS

Numbers 1 to 6, oral

1. If you have 80 words in a spelling test and are marked 90%, how many words did you spell correctly?

2. If you have 20 problems in arithmetic and are marked 90%, how many answers were correct?

3. If you have 40 questions in geography and are marked 75%, how many answers were correct?

4. If a dealer pays 4¢ apiece for pencils and sells them at 50% more than he paid, what must you pay for one?

5. If a milk dealer pays 10¢ a quart for milk and sells it at 20% more than it costs him, how much per quart does he receive for the milk?

6. If a butcher buys meat at 24¢ a pound and sells it at $33\frac{1}{3}$% more than it costs him, at what price per pound does he sell the meat?

7. In the world's championship series in a certain year the players' share was $135,000, of which the Giants received 60%. How much money did the Giants receive?

8. The players on the St. Louis team were at bat 4812 times in one season, and the base hits were 25% of the times at bat. How many base hits did they make?

9. A dealer in coats and suits advertised a reduction of 20% on overcoats. Find the selling price of a coat that, before the reduction, had sold for $100.

In Ex. 9 find the price of a coat that had sold for

10. $75. **11.** $65. **12.** $60. **13.** $50. **14.** $40. **15.** $30.

DRILL CHART IN FINDING PER CENTS

Find the following per cents:

1. 5% of \$48.
2. 2% of \$45.
3. 7% of \$140.
4. 6% of \$130.
5. 5% of \$1750.
6. 4% of \$2500.
7. 3% of \$6000.
8. $2\frac{1}{2}$% of \$8000.
9. $3\frac{1}{2}$% of \$5000.
10. 10% of \$7000.
11. 15% of \$48,000.
12. 22% of \$64,000.
13. 30% of \$1200.
14. 33% of \$1000.
15. $33\frac{1}{3}$% of \$1800.
16. $66\frac{2}{3}$% of \$1800.
17. $16\frac{2}{3}$% of \$4800.
18. $1\frac{1}{2}$% of \$2500.
19. $1\frac{1}{4}$% of \$3600.
20. $2\frac{1}{8}$% of \$4800.
21. $2\frac{3}{8}$% of \$72,800.
22. $5\frac{7}{8}$% of \$65,600.
23. 2.8% of \$25,000.
24. 3.7% of \$360,000.
25. Find $\frac{1}{2}$ of 100; $\frac{1}{2}$% of 100; 50% of 100.
26. Find $\frac{1}{2}$ of 400; $\frac{1}{2}$% of 400; 50% of 400.
27. Find 6% of \$100; 0.6% of \$100; 60% of \$100.

Find the value in each of the following cases:

28. 5% of \$200; 50% of \$200; $\frac{1}{2}$ of \$200.
29. 25% of \$1000; 2.5% of \$1000; $\frac{1}{4}$% of \$1000.
30. 1.25×200; $\frac{125}{100}$ of 200; 125% of 200.
31. 250×800; 250% of 800; $2\frac{1}{2} \times 400$.
32. 375×8000; 3.75×8000; 375% of 8000.

PROBLEMS ABOUT GEOGRAPHY

1. When the population of Texas was 4,500,000, it is said that 25% of the people lived within 100 mi. of Dallas. How many lived within that distance at that time?

2. The population of Alabama at one time was 2,140,000, and ten years later it had increased 9.3%. Find the population of the state then.

3. The receipts at the New Orleans docks were 125 carloads of freight on one day and 20% less the next day. What were the receipts on the second day?

4. Of 575 T. of ore shipped to Seattle in one day, 15% was sent by steamer. How much was sent by steamer?

5. If coal can be found under about 63% of the land in Illinois, which has an area of about 56,600 sq. mi., how many square miles of coal lands are there?

6. The area of the United States is 3,600,000 sq. mi., approximately, of which about $7\frac{1}{2}$% is in Texas. Find the number of square miles in Texas.

7. The total farm land of the United States contains about 880,000,000 A., of which 13% is in Texas. Find the number of acres of farm land in Texas.

8. Mt. McKinley, in Alaska, is 20,300 ft. high, and Blue Mountain, the highest elevation in Arkansas, is about 13.8% as high. Find the height of Blue Mountain to the nearest 100 ft.

9. North Truchas Peak in New Mexico is 13,306 ft. high, and East Peak in Nevada is about 1.2% lower. Find the height of East Peak to the nearest foot.

PROBLEMS ABOUT SCHOOLS

1. Of the 350 pupils enrolled in a certain school, 8% are in the sixth grade and 12% are in the fifth grade. How many pupils are there in each of these grades?

2. Of the 440 pupils in a certain school, 5% have been either tardy or absent this month. How many pupils have been either tardy or absent?

3. In a school which had 390 pupils last year, the increase in the enrollment this year is $3\frac{1}{3}\%$. How many pupils are there in the school this year?

4. If it is expected that there will be an increase of 4% in enrollment next year, how many pupils should be planned for in a school which now has 250 pupils?

5. In a school of 300 pupils $4\frac{2}{3}\%$ are absent today. How many pupils are absent?

6. If 15% of the 240 pupils of a school are new pupils this year, how many new pupils are there?

7. The class in cooking finds that food which costs $8.84 at one store can be bought for 12% less at another. How much can be saved by buying at the second store?

8. If there are 25 pupils in a class, and 40% are boys, what fractional part of the class are boys? How many boys are there? If 60% are girls, how many girls are there?

9. A class in industrial arts visiting a factory learned from the foreman that there was a shrinkage of $\frac{1}{2}\%$ in washing a certain kind of cloth. How much would 50 yd. of the cloth shrink? What would be the length of the cloth after it was washed?

One Number as a Per Cent of Another. For example, suppose that you spell correctly 95 words out of 100. Evidently, you have spelled correctly $\frac{95}{100}$, or 0.95, of the words. But $0.95 = 95\%$; that is, 95% of them are correct.

Similarly, if you spell correctly 9 words out of 10, you have $\frac{9}{10}$ correct. But $\frac{9}{10} = 0.9 = 0.90$; that is, 90% of the words are correctly spelled.

Again, if you have 100 examples to solve, and you solve them all correctly, you have solved correctly $\frac{100}{100}$ of the examples; that is, you have solved correctly 100% of them.

From these three examples we can see that

To find what per cent one number is of another divide the first by the second.

Thus, to find what per cent 95 is of 100, divide 95 by 100. The result is $\frac{95}{100}$, or 0.95; that is, it is 95%.

To find what per cent 4 is of 5, divide 4 by 5. The result is $\frac{4}{5}$, or 0.80; that is, it is 80%.

The whole of anything is $\frac{100}{100}$, or 100%, of it.

ONE NUMBER AS A PER CENT OF ANOTHER

Numbers 1 to 20, oral

State what per cent the first number is of the second:

1. 5, 100.	**6.** 10, 50.	**11.** 1, 10.	**16.** 5, 5.
2. 8, 100.	**7.** 20, 100.	**12.** 2, 10.	**17.** 1, 3.
3. 15, 100.	**8.** 125, 100.	**13.** 3, 10.	**18.** 1, 8.
4. 25, 100.	**9.** 200, 100.	**14.** 1, 5.	**19.** $12\frac{1}{2}$, 100.
5. 100, 100.	**10.** 250, 100.	**15.** 10, 10.	**20.** $33\frac{1}{3}$, 100.

21. If you miss 3 words out of 50 in a spelling test, what fraction of the words do you miss? How many hundredths do you miss? What per cent do you miss?

22. If you spell correctly 45 words out of 50, what per cent of the words do you spell correctly? What per cent do you miss? What per cent of the words is the sum of the number missed and the number spelled correctly?

23. If 2 out of a class of 40 are absent, what per cent are absent? What per cent are present? What per cent is equal to the sum of these two per cents?

Find what per cent the first number is of the second:

24. 25, 50.	**29.** $37\frac{1}{2}$, 50.	**34.** 12, 10.	**39.** 275, 100.
25. 12, 24.	**30.** $62\frac{1}{2}$, 50.	**35.** 10, 12.	**40.** 100, 300.
26. 35, 70.	**31.** 50, $62\frac{1}{2}$.	**36.** 15, 10.	**41.** 300, 100.
27. 6, 12.	**32.** 50, $37\frac{1}{2}$.	**37.** 10, 15.	**42.** 150, 300.
28. 10, 20.	**33.** 37, 74.	**38.** 20, 10.	**43.** 200, 400.

44. After you have gone 37.5 mi. on a trip of 75 mi., what per cent of the distance have you gone?

45. If 15 boys out of a school of 150 boys are selected for the baseball team, what per cent are selected?

46. Only 9 boys can play at a time on the team in Ex. 45. What per cent of the 15 boys play in any inning?

47. If your club wins 18 games out of 24, what per cent does it win? What per cent does it not win?

48. If the girls in a school of 350 number 182, what per cent of the pupils are girls? What per cent are boys? If you add the two per cents, what is the result?

RUNNING A STORE

1. If, in your store, you buy hunting knives at 90¢ each and sell them at \$1.35 each, how much more than the cost do you receive? This is what per cent of the cost?

2. Suppose that the expenses of carrying on your business in Ex. 1 (such as rent, hiring clerks, light, and other items) amount to 40% of the selling price, how much should you charge up as expenses in selling the knife?

3. Comparing the gain on the knife as found in Ex. 1 with the cost of doing business as found in Ex. 2, do you make money or lose money on the sale, and how much? This illustrates a very important point in business. One reason why merchants often fail to succeed is that they do not consider the cost of doing business. The estimate of 40% given in Ex. 2 is about what is often allowed.

4. If, in your store, you buy skates for \$1.60 a pair and sell them at \$2.80, you gain what per cent of the cost? If it costs you 40% of the selling price to do business, do you gain or lose on the skates, and how much per pair?

5. If you buy skates at \$1.60 and sell them at twice that price, it looks as if you were making a profit of 100%. But if you deduct 40% of the selling price for expenses, what amount per pair do you receive after making this allowance? This amount is how much more than the cost (\$1.60)? Your profit is what per cent of the cost?

6. If, after deducting for expenses, you receive \$4.86 when you sell a tennis racket that costs you \$4.50, what is your per cent of profit on the cost?

V. USES OF PER CENTS

A SILENT READING LESSON

If a person buys or sells property for another person, he acts as an *agent* and is entitled to be paid for his work. This payment is usually a certain per cent of the amount involved in the sale.

Suppose that you sell a house for Mr. X for $12,000. If your *commission* is 2%, you are paid 2% of $12,000, or $240 for your part in the transaction. In this case you are called a *real-estate agent* or a *realtor*.

Such agents find purchasers that the person wishing to sell the property cannot easily find. If he could find them himself, he would save the commission; but it might easily cost him as much in the end as he would pay the agent.

Suppose that your business is receiving farm produce from farmers and selling it for them. In this case you are called a *commission merchant*. If you sell some produce for $350 and receive 5% as your commission, you receive 5% of $350, or $17.50. You then send to the farmer $350 – $17.50, or $332.50, which is called the *proceeds* or *net amount* of the sale.

There is no great difference between a real-estate agent and a commission merchant in the matter of payment. The payment in each case depends upon the amount of money involved in the sale.

Besides their regular wages or salaries, the clerks in large stores are often paid a commission on the amount of the sales that they make to customers.

PROBLEMS IN COMMISSION

1. Suppose that you are a real-estate agent and that you sell a house for me for $8000. If you charge a commission of 2%, how much commission do I pay you?

2. If, as a real-estate agent, you sell my farm for $12,500 and charge me a commission of $2\frac{1}{4}$%, how much commission do you receive?

3. Suppose that you have an old automobile that you wish to sell, and that I can find a purchaser who is willing to pay $550 for it. If I charge you 5% for my services, how much will my commission be? What will be the proceeds that you receive from the sale?

In each of the following, which show the amounts of sales at different rates of commission, find the amount of commission paid:

4. $1000, 2%.	8. $12,500, $2\frac{1}{4}$%.	12. $125.50, 2%.
5. $7500, $2\frac{1}{2}$%.	9. $16,750, $3\frac{1}{2}$%.	13. $275.50, 4%.
6. $8750, 3%.	10. $15,000, $3\frac{3}{4}$%.	14. $9840, $4\frac{1}{2}$%.
7. $9875, 4%.	11. $18,600, $4\frac{1}{4}$%.	15. $7820, $6\frac{1}{2}$%.

In each of the following, which show the amounts of sales at different rates of commission, find the commission to the nearest cent and then find the net amount of the sale:

16. $280, $2\frac{1}{2}$%.	20. $720, $3\frac{3}{4}$%.	24. $175.50, 2%.
17. $460, 3%.	21. $820, $2\frac{1}{4}$%.	25. $325.75, $2\frac{1}{4}$%.
18. $540, $3\frac{1}{2}$%.	22. $580, $2\frac{3}{4}$%.	26. $428.60, $2\frac{3}{4}$%.
19. $680, $4\frac{1}{4}$%.	23. $1675, 4%.	27. $129.72, $3\frac{1}{4}$%.

A SILENT READING LESSON

If during a year a merchant receives more money from his sales than it costs him to buy goods and to pay the running expenses of his store, the business makes a profit; if he receives less money, the business is run at a loss.

Expenses like rent, heat, light, insurance, salaries, repairs, and so on are often called *overhead charges,* or simply *overhead.* We shall call all of these the "expenses of doing business," or simply "expenses."

Some merchants express profits and losses as per cents of what their goods cost them.

Suppose that a merchant, whose expenses average 32% of the cost of goods, buys 960 yd. of linen lawn at $87\frac{1}{2}$¢ a yard and sells it at $1.25 a yard. This is the way he solves the problem of finding his profit on the transaction:

$$\frac{7}{\cancel{8}} \times \overset{120}{\cancel{960}} = 840 \text{ (cost)}$$

$$\begin{array}{r l}
840 & \\
1.32 & \\
\hline
1680 & \\
2520 & \\
840 & \\
\hline
1108.80 & \text{(cost + expenses)}
\end{array}
\qquad\qquad
\begin{array}{r l}
960 & \\
1\frac{1}{4} & \\
\hline
240 & \\
960 & \\
\hline
1200 & \text{(sales)} \\
1108.80 & \\
\hline
91.20 & \text{(profit)}
\end{array}$$

The merchant did not use the dollar signs, and in finding $960 \times 87\frac{1}{2}$¢, he took $\frac{7}{8}$ of $960. Since the expenses were 32% of the cost of goods, he saw that to find the amount of the cost plus expenses, he could multiply by 1.32, instead of multiplying by 0.32 and then adding $840.

PROBLEMS IN PROFIT OR LOSS

1. On some goods which cost $4920 a merchant wishes to make a profit of 10% of the cost. Find the amount of the profit that he wishes to make.

2. The merchant in Ex. 1 knows that his expenses average 20% of the cost of the goods he sells. How much must he allow for expenses in Ex. 1? For how much should he sell the goods if he is to clear his expenses and make the desired profit?

3. A man sold a house for which he had paid $11,520 at a loss of 4%. How much was his loss? If he spent $300 for repairs and $180 for other expenses before selling the house, how much was his total loss?

4. A dealer pays $4.32 a gross for penholders and sells them at a price which is $66\frac{2}{3}$% more than the cost. Find the price at which he sells each penholder.

5. A hardware dealer bought a lot of tools for $1937.50. His expenses of doing business average 18% of the cost of goods. If on the lot he wishes to make a profit of 12% of the cost, for how much should he sell the tools?

6. A dealer buys 80 sewing machines at $72 apiece and sells them all at $96 apiece. He pays $36 freight on the lot, and his other expenses are $9.40 per machine. Find his profit on the lot.

7. A merchant buys 12 gross of spools of silk at $9.76 a gross. He sells the entire lot of spools at $1.20 a dozen. Allowing 20% of the cost for expenses, how much is the profit that he makes?

8. A merchant buys 840 yd. of muslin at 28¢ a yard and sells it at the rate of a dozen yards for \$4.25. His expenses are $3\frac{3}{4}$¢ per yard. How much is his profit or loss?

9. A dealer buys 740 yd. of scrim for \$200, and sells 75% of it at 45¢ a yard and the rest at 30¢ a yard. Allowing 18% of the cost of the goods for expenses, how much is his profit or loss?

10. A dealer buys 380 reams of paper at \$2.25. He sells 90 reams, which were damaged, at 85¢, and the rest at \$3.25. Allowing 40¢ a ream for expenses, find his profit or loss on the lot.

11. A dealer buys 720 yd. of cloth at \$1.36 a yard and wishes to make a profit of about \$100 on the lot. Allowing 22% of the cost for expenses, find to the next higher cent the price per yard which he should ask for the cloth.

12. A dealer buys 1600 yd. of Victoria lawn for \$600. If on this lot he estimates that the proper share of the expenses of doing business is \$108, for how much per yard must he sell the lawn to make a profit of $3\frac{3}{4}$¢ a yard? He sees that this is an awkward price and so sells the cloth at 50¢ a yard. Find his total profit on the lot.

13. A dry-goods dealer buys 840 yd. of percaline at 38¢ a yard and estimates that his expenses are 5.7¢ a yard. He sells 500 yd. at 50¢ a yard, 120 yd. at 48¢ a yard, and the rest at 28¢ a yard. How much is his profit or loss?

14. A merchant's expenses average 28% of the cost of goods. If he wishes to make a profit of 12% of the cost, for how much per yard should he sell silk for which he pays \$3.50 per yard?

Interest for a Year. Imagine that you are going into business and wish to buy a store and its stock of goods. You should have money enough to pay for at least part of the store, and should have experience enough to be reasonably certain of success. You can then borrow the money to pay for the rest of the store.

When people borrow money, they pay a certain per cent for its use. If you borrow \$100 for 1 yr., you may be asked to pay 6% of this amount, or \$6, for the year. This \$6 is called the *interest* on the \$100.

If you borrow \$200 for 1 yr. at 6%, the interest for the year is 6% of \$200, or \$12.

If you borrow \$300 for 1 yr. at 5%, the interest for the year is 5% of \$300, or \$15.

INTEREST FOR A YEAR

Find the interest for 1 yr. on each of the following amounts at the rate given:

1. \$100, 5%.
2. \$100, 7%.
3. \$100, 4%.
4. \$200, 5%.
5. \$200, 6%.
6. \$200, 4%.
7. \$300, 4%.
8. \$300, 5%.
9. \$300, 6%.
10. \$300, 7%.
11. \$50, 6%.
12. \$500, 6%.
13. \$5000, 6%.
14. \$75, 5%.
15. \$750, 5%.
16. \$7500, 5%.
17. \$25, 4%.
18. \$250, 4%.
19. \$2500, 4%.
20. \$2500, 5%.
21. \$150, 4%.
22. \$150, $4\frac{1}{2}$%.
23. \$150, $5\frac{1}{2}$%.
24. \$80, 6%.
25. \$80, $5\frac{1}{2}$%.
26. \$800, $5\frac{1}{4}$%.
27. \$8000, $5\frac{3}{4}$%.
28. \$5000, $5\frac{1}{4}$%.
29. \$6000, $5\frac{3}{4}$%.
30. \$6000, $7\frac{1}{2}$%.

Interest for Other Lengths of Time. If you borrow money for 2 yr., the interest is twice as much as for 1 yr.; if you borrow for 6 mo., or $\frac{1}{2}$ yr., the interest is half as much as for 1 yr.; if you borrow for $2\frac{1}{2}$ yr., the interest is $2\frac{1}{2}$ times the interest for 1 yr.

For example, suppose that you wish to borrow \$150 for 1 yr. 6 mo.; that is, for $1\frac{1}{2}$ yr.

The interest for 1 yr. will be $0.06 \times \$150$, or \$9, and so the interest for $1\frac{1}{2}$ yr. will be $1\frac{1}{2} \times \$9$, or \$13.50.

FINDING INTEREST

1. Mr. Jackson borrows \$300 to help start a gasoline filling station, and keeps it for 2 yr. If he has to pay interest at 6%, how much interest does he pay?

Find the interest for 2 yr. on each of the following amounts at the rate given:

2. \$200, 5%. **6.** \$150, 6%. **10.** \$150, $5\frac{1}{2}$%.
3. \$300, 5%. **7.** \$150, 5%. **11.** \$250, $5\frac{1}{2}$%.
4. \$500, 4%. **8.** \$250, 4%. **12.** \$3750, 6%.
5. \$500, 6%. **9.** \$350, 6%. **13.** \$5250, 5%.

Find the interest on each of the following amounts for the given time and rate:

14. \$100, $\frac{1}{2}$ yr., 6%. **19.** \$260, $\frac{1}{2}$ yr., 5%.
15. \$100, $1\frac{1}{2}$ yr., 6%. **20.** \$480, $1\frac{1}{2}$ yr., 5%.
16. \$100, 2 yr., 6%. **21.** \$800, $2\frac{1}{2}$ yr., 5%.
17. \$100, $2\frac{1}{2}$ yr., 6%. **22.** \$4000, $\frac{1}{2}$ yr., 4%.
18. \$500, $2\frac{1}{2}$ yr., 6%. **23.** \$6000, $1\frac{1}{2}$ yr., 6%.

A SILENT READING LESSON

Sometimes merchants have bargain sales at which they try to dispose of odd pieces or of goods that are going out of style. At such times they often sell goods at a certain "per cent off" the *marked price*, which is the price marked on the goods.

For example, an article marked \$3.50 and sold at 10% off is sold at \$3.50 less 10% of \$3.50; that is, we have

$$\$3.50 - \$0.35 = \$3.15.$$

A reduction from a price or amount is called a *discount*. If you offer to sell for \$2 a tennis racket that costs \$3, you are offering to sell it at a discount of \$1, or at a discount of $\frac{1}{3}$, or at a discount of $33\frac{1}{3}\%$. The last expression is the common form used in business.

The price of an article after the discount has been taken off is called the *net price* or *selling price* of the article; and, similarly, the amount of a bill after the discount has been taken off is called the *net amount* of the bill.

Marked Price	
Net Price	Discount

Business men who sell at wholesale (that is, to dealers) often sell at a discount from the price stated in their catalogues, or from the *list price*, as it is called.

The work at the right shows how we find the net price when a library table listed in a catalogue at \$245 (the list price) is sold at a discount of 30%. We first find the amount of the discount, \$73.50, and subtract it from the list price.

\$245	\$245.00
0.30	73.50
\$73.50	\$171.50

FINDING DISCOUNTS

Numbers 1 to 9, oral

1. If a baseball mitt that is marked \$2.80 can be bought at 10% off this price, what is the amount of the discount? By subtracting this from \$2.80, find the net price.

2. If a tennis racket that is marked \$4.50 is offered at a discount of 20%, what is the discount? As in Ex. 1, what is the net price?

3. Solve Ex. 2 another way by first taking 20% from 100%, leaving 80%. Then take 80% of \$4.50. Tell why this gives the same result as was found in Ex. 2.

Find, as in Ex. 2 and also as in Ex. 3, the net prices when the marked prices and the discounts are as follows:

4. \$8, 10%.	**6.** \$60, $33\frac{1}{3}$%.	**8.** \$300, 10%.
5. \$12, 25%.	**7.** \$80, 25%.	**9.** \$500, 20%.

10. On an automobile which sells regularly at \$1520 a man is offered a discount of 12%. Find the net price.

11. A suit of clothes marked \$33 is advertised to be sold at $33\frac{1}{3}$% off. What is the net price?

12. A dealer offers a discount of $33\frac{1}{3}$% on Boy-Scout suits marked \$17.85 each. Find the net price.

13. If a suit of clothes marked \$28 is purchased at a discount of 15%, how much is saved on the marked price?

14. If the cost of the books, pencils, and paper which you use in a year is \$8.50 at list prices, how much do they cost at a discount of 8%? Check by taking 92% of \$8.50.

A SILENT READING LESSON

When a merchant wishes to order goods for his store, he may do so in several ways. He may give his order to the salesman who visits his store, he may order by telephone, or he may write to the wholesaler or manufacturer. In ordering goods, business houses generally use printed forms, which are filled in to show the quantity, style, prices, and other details of the order.

When the wholesaler or manufacturer ships the goods that the merchant ordered, an *invoice* (which is only another name for a bill) showing all the details of the shipment is mailed to the merchant. The following model shows a simple form of the invoice covering a shipment of goods on which the merchant is allowed a discount of 40% from the list prices in the manufacturer's catalogue:

Feb. 16, 1928

BROWN & HART

Manufacturers

Portland, Oreg.

R. T. Brown & Son
242 Pine St.
Oregon City

Your Order No. 126
Our Order No. 7684
Shipped by Express

Quantity	*Stock No.*	*Article*					
50	127	Brass Door Plates	.85	42	50		
125	346	Brass Cupboard Catches	.35	43	75		
60	269	Bronze Letter Slots	1.75	105	00		
				191	25		
		Discount, 40%		76	50		
						114	75

In computing discounts, we follow the business practice in regard to fractions of a cent; that is, we count $\frac{1}{2}$¢ or more as a full cent and disregard anything less than $\frac{1}{2}$¢.

FINDING DISCOUNTS

Write invoices for the following orders for goods:

1. 8 chairs @ \$6.50; 12 armchairs @ \$9.25; 8 rocking-chairs @ \$14.50; 24 tables @ \$42.75. Discount, $33\frac{1}{3}\%$.

2. 420 yd. satin @ \$3.50; 340 yd. flannel @ \$1.60; 400 yd. canvas @ 90¢. Discount, $37\frac{1}{2}\%$.

3. 750 yd. lawn @ 90¢; 450 yd. fancy percale @ 60¢; 380 yd. satin @ \$4.50. Discount, 15%.

4. 250 yd. serge @ \$3.25; 300 yd. cheviot @ \$2.75; 175 yd. velvet @ \$3.40. Discount, 20%.

5. 75 doz. plates @ \$9.25 (per dozen); 60 doz. cups and saucers @ \$11.00; 40 doz. tumblers @ \$2.40; 12 doz. individual butter plates @ \$1.75. Discount, 35%.

Find the amounts of the following discounts:

6. 15% on \$4000.
7. 20% on \$2400.
8. 10% on \$5750.
9. 12% on \$7850.
10. 18% on \$2235.
11. 15% on \$32,350.
12. $33\frac{1}{3}\%$ on \$6336.
13. $37\frac{1}{2}\%$ on \$7328.
14. 25% on \$472.64.
15. $16\frac{2}{3}\%$ on \$94.54.

On orders for goods to the following amounts find the net amounts at the discounts given:

16. \$375, 20%.
17. \$475, 5%.
18. \$663, 3%.
19. \$850, $12\frac{1}{2}\%$.
20. \$886, 16%.
21. \$925, 10%.
22. \$620, 14%.
23. \$32.75, 20%.
24. \$4202, 14%.
25. \$5672, $12\frac{1}{2}\%$.
26. \$58.84, $16\frac{2}{3}\%$.
27. \$76.32, 50%.

REVIEW DRILL CHART IN PER CENTS

Find the value in each of the following cases, using fractions or short methods whenever it is easier:

1. 40% of 280.	8. 5% of 320.	15. $\frac{3}{4}$ of 1236.
2. 50% of 380.	9. 8% of 730.	16. 75% of 1236.
3. 60% of 450.	10. 9% of 925.	17. 0.75×1236.
4. 70% of 920.	11. $4\frac{1}{2}$% of 735.	18. $\frac{1}{5}$ of 295.
5. 50% of \$480.	12. 3% of \$628.	19. 20% of 295.
6. 30% of \$260.	13. 8% of \$448.	20. $\frac{3}{4}$ of 964.
7. 80% of \$22.	14. 9% of \$868.	21. 75% of 964.

On orders for goods to the following amounts find the net amounts at the discounts given:

22. \$750, 20%.	25. \$975, 8%.	28. \$1560, $16\frac{2}{3}$%.
23. \$475, 15%.	26. \$1640, $12\frac{1}{2}$%.	29. \$9768, $12\frac{1}{2}$%.
24. \$880, 25%.	27. \$1775, 24%.	30. \$4578, $33\frac{1}{3}$%.

Find the value in each of the following cases:

31. $12\frac{1}{2}$% of \$9860.	37. $37\frac{1}{2}$% of \$16,888.
32. $16\frac{2}{3}$% of \$9860.	38. 50% of \$24,770.
33. 25% of \$16,480.	39. 23.8% of \$42,869.
34. $\frac{1}{2}$% of \$12,400.	40. $3\frac{1}{8}$% of \$7200.
35. 50% of \$12,800.	41. $62\frac{1}{2}$% of \$16,896.
36. $33\frac{1}{3}$% of \$6888.	42. $5\frac{1}{2}$% of \$1200.

VI. REVIEW AND DRILL

MINIMUM ESSENTIALS

1. Write in our common numerals the number sixty million three hundred thousand two hundred nine.

2. Write in our common numerals the number ninety-two and forty-four thousandths.

Add as follows:

3.	4.	5.	6.	7.
$7.98	$4.62	$8.43	$3.89	$9.48
.85	3.46	4.84	4.94	8.21
4.79	.34	7.06	7.43	.32
5.68	.62	8.06	8.52	5.87
.52	9.75	9.54	9.48	6.78
.48	8.25	8.46	4.87	.22
8.72	3.38	9.50	5.96	8.95
6.55	4.42	8.72	8.96	2.05

8. Add $98.86 and $74.69 and then subtract $109.57.

9. Add $95.42 and $87.69 and then subtract $129.78.

10. Multiply 48.756 by 0.078 and then add 0.723682.

11. Divide 37.84 by 6.93, finding the result correct to two decimal places; that is, to the nearest hundredth.

Perform the following operations:

12. $\frac{7}{8} + \frac{3}{4}$.

13. $\frac{7}{8} - \frac{1}{4}$.

14. $\frac{1}{2} - \frac{1}{3}$.

15. $\frac{3}{16} + \frac{1}{2}$.

16. $\frac{7}{16} \div \frac{1}{2}$.

17. $\frac{9}{16} \div \frac{3}{4}$.

18. $1\frac{1}{2} + 2\frac{7}{8}$.

19. $3\frac{1}{3} + 2\frac{1}{2}$.

20. 0.7×1.2.

21. 1.7% of 380.

22. 2.3% of 9.25.

23. $1.44 \div 1.2$.

PROBLEMS WITHOUT NUMBERS

All work oral

1. How do you find a fraction of a fraction?

2. How do you find the number of square feet of flooring needed to cover the floor of your schoolroom?

3. How do you find the cost of a sidewalk to be laid in front of the schoolhouse?

4. If you are asked to find the number of square yards of concrete that will be needed for a garage floor, how do you find it?

5. I have measured the length and width of a rectangular room in feet. How do I find the number of square yards of linoleum needed to cover the floor?

6. I know the length, width, and height of a rectangular room in feet. How do I find the number of square yards of plastering needed for the walls and ceiling, making no allowance for the doors and windows?

7. If you know what an automobile dealer pays for a car, and the per cent above cost at which he sells it, how do you find the selling price?

8. If you know the per cent of discount that a dealer is allowed in buying from a wholesaler, how do you find the net amount of the invoice covering an order for goods costing a certain amount?

9. If you know the rate of commission paid a real-estate agent, and the price at which he sells a house, how do you find the amount of the agent's commission?

PROBLEMS FOR COMPLETION

1. Mr. Brown bought at a reduction of 20% an automobile that had been marked $1985. The dealer also allowed him $325 for his old car. Complete the problem in any reasonable way and then solve it.

Complete and solve the following problems:

2. In a recent year the average consumption of meat for each person in this country was as follows: beef, 82.7 lb.; mutton, 7 lb.; pork, 103.5 lb.; other kinds of meat, 0.3 lb.

3. A woman who used gas for cooking bought a fireless cooker, and found that her gas bills, which had been $3.85, $3.80, $3.75, $3.20, and $2.90 for the first 5 mo. of last year, were now $3.10, $3, $2.90, $2.40, and $2.10 for the first 5 mo. of this year.

4. In his garden Fred raised 150 lb. of tomatoes, one third of which he sold to the neighbors at 8¢ a pound, and the rest at 6¢ a pound.

5. John bought a pig for $5.75. He fattened the pig, spending $11.75 for feed. When the pig weighed 240 lb., John sold it at 9¢ a pound.

6. A man who works in a machine shop earns $36 a week. He pays $10 a week for his board and room. His other expenses amount to 20% of his earnings.

7. Mary's recipe for making molasses candy called for 2 cups of molasses, 1 tablespoon of vinegar, 2 tablespoons of butter, $\frac{1}{2}$ teaspoon of baking powder, 1 teaspoon of ginger extract. This was enough to make 1 lb. of candy. She wished to make 3 lb. for a church sale.

Testing Your Alertness. In the four lines below, a certain relation exists between the first two words, and a line is drawn under the word in parentheses that has the nearest similar relation to the third word in the line:

1. Square, side; cube, (area, edge, weight).
2. Foot, inch; pound, (ounce, ton, quart).
3. Bushel, peck; one, (six, sixth, fourth).

ALERTNESS TEST

After you understand numbers 1, 2, and 3, above, see if you can copy the lines given below, underlining the right words in each case, all in 10 min.:

1. Foot, inch; year, (area, month, rod).
2. Mile, rod; year, (day, foot, length).
3. Degree, minute; minute, (second, earth, clock).
4. Inch, foot; one, (tenth, seven, twelve).
5. Day, week; two, (seven, seventh, fourteen).
6. Second, minute; minute, (time, hour, week).
7. Triangle, rectangle; three, (five, seven, four).
8. Quart, pint; six, (ten, twelve, three).
9. One, half; four, (fourth, two, eight).
10. Year, month; foot, (rod, inch, mile).
11. Half, six; three, (ten, thirty-six, forty-eight).
12. Zero, ten; one, (twelve, eleven, ten).
13. Hundredth, one; fiftieth, (half, two, fourth).
14. Hour, week; minute, (day, area, ten).
15. Sale, commission; money, (interest, dollar, cent).
16. Per cent, hundredths; result, (even, odd, answer).

RAISING POULTRY

1. Tom Wallace set 260 eggs and hatched 85% of them. How many chickens hatched?

2. Tom sold 134 of his chickens for a total of \$57.62. Find the average price received per chicken.

3. Tom's hens laid 699 eggs in April, 544 in May, 522 in June, 425 in July, 290 in August, and 112 in September. How many dozen eggs did his hens lay in these months?

4. In Ex. 3, Tom sold the eggs to a storekeeper at an average price of 48¢ a dozen. How much did he receive from the sale of his eggs?

5. Tom bought 3 geese at \$2 each and paid \$3.50 for feed. He raised 13 young geese, which he sold to the butcher at an average price of \$1.50 each. How much did Tom make above his expenses?

6. In School District No. 6 there was a poultry club which reported that its members had sold 1345 eggs in March, 1209 in April, and 1142 in May, and that the average price received for the eggs was $42\frac{1}{2}$¢ a dozen. How much did the club members receive from the sale of eggs in these months?

7. In Ex. 6, if there were 77 hens laying eggs, what was the average number of eggs laid per hen during this period?

8. In School District No. 2 the poultry club's records showed that 1276 eggs were sold in March, 1140 in April, and 1070 in May, and that the average price received was $44\frac{1}{2}$¢ a dozen. How much was received from the sale of eggs in these months?

A SILENT READING LESSON WITH PROBLEMS

Last year Tom decided to join the garden club. He bought 25 lb. of onion seed and rented 69 sq. rd. of land from his grandfather. His uncle showed him how to sow the seed. His grandfather told him all about raising onion sets and showed him some of the latest and best methods. Tom followed his grandfather's advice, and the crop was very satisfactory. He gave his mother the money left over after paying the expenses, and she used it in paying for music lessons for Tom and his sister.

The itemized account of Tom's receipts and expenditures appears on page 321. The items are all for this year except the first two expenditures, which were made in November of last year.

If any of us should undertake work like this, we should need to know how to keep an account of the receipts and expenses. There are some interesting questions that can be asked about Tom's work and his account. Let us consider a few of them:

1. Tom had 69 sq. rd. of land. How many pounds of onion sets did he raise per square rod?

2. Considering all Tom's expenses, what was the cost per square rod?

3. At the rate found in Ex. 2, what would be Tom's expenses for an acre?

4. How much per square rod did Tom find that he made above his expenses?

5. At the rate found in Ex. 4, how much could Tom make if he planted an acre?

Copy the following account, completing it by filling in the places marked by the stars:

Receipts

Sept.	24,	6480 lb. onion sets at $5\frac{1}{2}$¢	$ ***
Oct.	1,	580 lb. overruns at $2\frac{1}{4}$¢	$13.20
		Total	***

Expenditures

Nov.	2,	Fertilizer, including hauling . . .	$9.00
Nov.	4,	Plowing	1.80
Feb.	17,	25 lb. onion seed at 75¢	***
Apr.	10,	Preparing land for seeding	1.00
Apr.	10,	Sowing onion seed	.65
May	14,	Wheel-hoeing, $4\frac{1}{2}$ hr. at 15¢	***
May	18,	Weeding, 20 hr. at 15¢	***
May	28,	Wheel-hoeing, $4\frac{1}{2}$ hr. at 15¢	***
June	7,	Weeding, 20 hr. at 15¢	***
Aug.	6,	Loosening sets with harvester . . .	.75
Aug.	6,	Harvesting 485 baskets at 5¢ . . .	***
Aug.	6,	5 men for harvesting, stacking, and covering crates, 25 hr. at 40¢ . .	***
Aug.	6,	Tar paper to cover stacks	.59
Aug.	6,	26 lunches at 25¢	***
Aug.	6,	Rent of 114 onion crates at 7¢ . . .	***
Sept.	19,	Grading 192 bu. onion sets at 3¢ . .	***
Sept.	19,	Marketing	7.00
Oct.	1,	Rent of land	7.50
		Total	***
		Balance	***

EARNING MONEY

1. Ben planted a piece of land to corn at an expense of \$31. An early frost damaged the crop so that it sold for only \$46.50, or half of what he expected. Ben wanted to put \$100 in the bank. If he had secured a full crop, how much would he have needed to make up the \$100?

2. Horace planted potatoes on $35\frac{1}{2}$ sq. rd. of land, which he rented from his father for 20¢ a square rod. His father gave him the seed potatoes and charged him \$1.25 for plowing. Horace did the rest of the work himself. If he raised 37 bu. of potatoes and sold them at \$1.30 a bushel, how much did he make above expenses?

3. In January, Arnold paid \$5 for some hens and by August had raised 41 chickens that his hens had hatched from their own eggs. He sold the chickens at \$1.50 each. Before he set the hens, he sold 10 doz. eggs at an average price of 60¢ a dozen. He found that the total expenses for care and feed were \$25.50. How much did Arnold make above his expenses?

4. Oscar planted onions in his home garden, paid out \$4.15 for expenses, and sold the entire crop for \$52.25. He then bought a bicycle for \$20 and 2 pigs at \$8 each. How much money did he have left?

5. Harry had a plot of ground 22 ft. wide and 275 ft. long. On it he raised 20 bu. of potatoes at a total expense of \$3.85. He sold the potatoes at \$1.75 a bushel. How much did Harry make above expenses? At this rate, how much might he expect to make from an acre of land?

MISCELLANEOUS PROBLEMS

1. A man makes a profit of $12\frac{1}{2}\%$ in selling property which cost him \$3200. How much is the profit?

2. A typewriter was marked \$90, but was sold at a discount of 15%. What was the net price?

3. An automobile regularly selling for \$1275 was sold at a discount of 12%. What was the net price?

4. A discount of $16\frac{2}{3}\%$ on \$5438.40 is \$90.64, \$9.06, \$9064, or \$906.40. Which is it?

5. A man buys a house for \$8750 and pays 30% down. How much does he pay down? How much does he owe?

6. A man agrees to buy a building lot for \$1575 and pays $33\frac{1}{3}\%$ down. How much has he still to pay?

7. A man bought a house for \$8400 and sold it for 125% of what he had paid for it. How much did he gain?

8. The diameter of a circle is about 31.8% as long as the circumference. Find to the nearest 0.01 ft. the diameter of a circle with a circumference of 200 ft.

9. A meter is about 9.3% longer than a yard. How much does this differ from 39.37 in., which is the equivalent length legally established in this country?

10. The nautical mile, which is used in measuring distances at sea, is about 15.2% longer than the common mile. About how many feet are there in a nautical mile?

11. A merchant who bought goods amounting to \$5062.50 at list prices was allowed a discount of 20%. What was the net amount of the invoice?

VII. LITTLE EXAMINATIONS

I.

1. $62\frac{1}{2}$ ft. = (?) in.
2. $7\frac{1}{4}$ pk. = (?) qt.
3. $42\frac{1}{2}$ gal. = (?) qt.
4. $3\frac{1}{2}$ hr. = (?) min.
5. $329.75 ÷ 25.
6. 1340 × $5276.45.
7. 4876 × $328.72.
8. 875 × $8642.75.

II.

1. 66 ft. = (?) rd.
2. 63 sq. ft. = (?) sq. yd.
3. 800 sq. rd. = (?) A.
4. 10,560 ft. = (?) mi.
5. 38 × $42\frac{1}{2}$ sq. ft.
6. $9\frac{1}{2}$ × $15\frac{1}{2}$ sq. ft.
7. 5 × 9 ft. 8 in.
8. 9 × 5 lb. 8 oz.

III.

1. 1280 A. = (?) sq. mi.
2. 390 min. = (?) hr.
3. 8 ft. 7 in. + 3 ft. 2 in.
4. 9 ft. 9 in. − 2 ft. 11 in.
5. 11 yd. − 5 yd. 9 in.
6. 8 × 9 ft. 3 in.
7. 12 × 8 yd. 6 in.
8. 16 × $24\frac{1}{2}$ sq. rd.
9. $\frac{1}{2}$ × 8 × 4 sq. ft.
10. $\frac{1}{2}$ × 6 × $8\frac{1}{2}$ sq. ft.

IV.

1. $61\frac{2}{3}$ in. + $3\frac{1}{2}$ in.
2. $7\frac{3}{8}$ in. − $5\frac{3}{4}$ in.
3. $\frac{1}{2}$ of $8\frac{3}{4}$ × $9\frac{1}{2}$ in.
4. $7\frac{7}{8}$ ft. ÷ $4\frac{7}{16}$ ft.
5. 5.75 ÷ $2\frac{1}{2}$.
6. $5.25 ÷ $1\frac{1}{4}$.
7. 38% of $9.60.
8. $\frac{2}{3}$ of $13\frac{1}{2}$ ft.
9. $\frac{7}{8}$ of 17 ft. 4 in.
10. 75% of $14\frac{1}{4}$ lb.

V.

1. $16\frac{2}{3}$% of $8.46.
2. $12\frac{1}{2}$% of $96.40.
3. $37\frac{1}{2}$% of $97.60.
4. $62\frac{1}{2}$% of $41.60.
5. $87\frac{1}{2}$% of $43.20.
6. $2\frac{1}{2}$% of $650.
7. $3\frac{1}{3}$% of $4.20.
8. 0.09% of $84.00.
9. $2.3\frac{1}{3}$% of $75.
10. 250% of 180 ft.

TABLES FOR REFERENCE

Length

12 inches (in.) = 1 foot (ft.)
3 feet = 1 yard (yd.)
$5\frac{1}{2}$ yards, or $16\frac{1}{2}$ feet = 1 rod (rd.)
320 rods, or 5280 feet = 1 mile (mi.)

Square Measure

144 square inches (sq. in.) = 1 square foot (sq. ft.)
9 square feet = 1 square yard (sq. yd.)
$30\frac{1}{4}$ square yards = 1 square rod (sq. rd.)
160 square rods = 1 acre (A.)
640 acres = 1 square mile (sq. mi.)

Cubic Measure

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.)
27 cubic feet = 1 cubic yard (cu. yd.)

Weight

16 ounces (oz.) = 1 pound (lb.)
2000 pounds = 1 ton (T.)

Liquid Measure

2 pints = 1 quart (qt.)
4 quarts = 1 gallon (gal.)

Dry Measure

2 pints (pt.) = 1 quart (qt.)
8 quarts = 1 peck (pk.)
4 pecks = 1 bushel (bu.)

Time

60 seconds (sec.) = 1 minute (min.)
60 minutes = 1 hour (hr.)
24 hours = 1 day (da.)
7 days = 1 week (wk.)
12 months (mo.) = 1 year (yr.)

A common year has 365 da., and a leap year has 366 da.

Angles and Arcs

60 seconds ($''$) = 1 minute ($'$)
60 minutes = 1 degree ($^\circ$)

Counting

12 units = 1 dozen (doz.)
12 dozen, or 144 units = 1 gross (gr.)

Paper

24 or 25 sheets = 1 quire
20 quires = 1 ream

For folded paper the quire is usually 24 sheets; for unfolded paper it is 25 sheets. Paper is sold also by weight.

Practical Equivalents

1 bu. contains $1\frac{1}{4}$ cu. ft., or 2150 cu. in.
1 bbl. contains 4.2 cu. ft., or $31\frac{1}{2}$ gal.
1 gal. contains 231 cu. in.
1 cu. ft. contains $7\frac{1}{2}$ gal.
1 cu. ft. of water weighs $62\frac{1}{2}$ lb.
1 cd. (cord) of 4-foot wood occupies 128 cu. ft.
1 T. of hard coal occupies 35 cu. ft.
1 T. of soft coal occupies 42 cu. ft.

These are in general only approximations, but they give results sufficiently close for ordinary computations.

INDEX

ANSWERS

Page 3. **6.** Hundreds; tens; units. **7.** Units; thousands; millions; billions. **8.** One million. **9.** 6,025,059. **10.** Three million four hundred ninety-two thousand six. **11.** Three-two-o-seven. **12.** Six dollars and twenty-five cents. **13.** Thirty-seven cents. **14.** Forty-five thousand eight hundred fifty. **15.** Eighty-four thousand nine hundred nine. **16.** Two hundred thirty thousand four hundred thirty-eight. **17.** Seven hundred thousand seven. **18.** Six million eight hundred forty-two thousand seven hundred fifty-nine. **19.** Thirty-two million three hundred twenty-nine thousand six hundred forty-six. **20.** 6,000,006.

Page 5. **4.** X, XX, XXX, XL, L, LX, LXX, LXXX, XC. **5.** C, CC, CCC, CCCC (or CD), D, DC, DCC, DCCC, DCCCC (or CM). **6.** 25. **7.** 1888. **8.** 14. **9.** 16. **10.** 25. **11.** 19. **12.** 71. **13.** 119. **14.** 87. **15.** 1930. **16.** XXXIX. **17.** XLVIII. **18.** LVIII. **19.** MDCCLXXV. **20.** MDCCCCXXXII (or MCMXXXII).

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Page 12. **1.** \$35.30. **2.** \$8.80. **3.** 12,700 cu. ft. **4.** 643 mi. **5.** \$18.04. **6.** \$18.15. **7.** \$31.89. **8.** \$19.00. **9.** \$31.75.

Page 13. **1.** \$75.45. **2.** \$177.53. **3.** \$53.09. **4.** \$106.87. **5.** \$120.31. **6.** \$76.17. **7.** \$236.87. **8.** \$146.76. **9.** \$55.00. **10.** \$74.30. **11.** \$108.94. **12.** \$152.14. **13.** \$10,291.72. **14.** \$12,189.87. **15.** \$6474.76. **16.** \$15,155.69.

Page 14. **1.** 2684. **2.** 1359. **3.** 549. **4.** 2039. **5.** 6829. **6.** 3774. **7.** 2315. **8.** 548. **9.** 1334. **10.** 3925. **11.** 3698. **12.** 4383. **13.** 2476. **14.** 1855. **15.** 3406. **16.** 4663. **17.** 3425. **18.** 3214. **19.** 1373. **20.** 6284. **21.** 4445. **22.** 4074. **23.** 2307. **24.** 1843. **25.** 5074.

Page **15.** **1.** 35,128. **2.** 14,387. **3.** 28,834. **4.** 4289. **5.** 13,750. **6.** 24,116. **7.** 18,041. **8.** 23,981. **9.** 21,729. **10.** 3828. **11.** 10,655. **12.** 36,791. **13.** 22,601. **14.** 10,897. **15.** 56,480. **16.** 13,884. **17.** 14,796. **18.** 26,109. **19.** 46,787. **20.** 15,603. **21.** 14,754. **22.** 42,636. **23.** 28,917. **24.** 14,445. **25.** 32,445. **26.** 15,890. **27.** 43,172. **28.** 25,350. **29.** 11,091. **30.** 13,719. **31.** 45,697. **32.** 32,877. **33.** 51,274. **34.** 43,191. **35.** 35,312. **36.** 19,053.

Page **16.** **1.** $297.10. **2.** $184.07. **3.** $493.64. **4.** $560.07. **5.** $332.87. **6.** $483.48. **7.** $679.88. **8.** $256.30. **9.** $14.69. **10.** $378.38. **11.** $373.95. **12.** $391.44. **13.** $661.82. **14.** $678.79. **15.** $406.24. **16.** $888.86. **17.** $78.86. **18.** $43.62. **19.** $269.47. **20.** $172.35. **21.** $141.79. **22.** $330.24. **23.** $409.29. **24.** $321.48. **25.** $272.84. **26.** $312.50. **27.** $388.26. **28.** 266,133. **29.** 323,993. **30.** 571,035. **31.** 153,643. **32.** 625,571. **33.** 337,893. **34.** 837,778. **35.** 607,075. **36.** 350,565.

Page **18.** **1.** $1.55. **2.** $1.24. **3.** $3.13. **6.** $30.78; $4.22.

Page **19.** **1.** $2.75; $2.25. **2.** $13.90. **3.** $19.35; 65¢. **4.** $6.50; $5 bill, $1 bill, 50¢. **5.** $4.25. **6.** 40¢. **7.** $1.75. **8.** $1.50.

Page **21.** **1.** $3.75. **2.** $1.85. **3.** $5.34. **4.** $21.55. **5.** $133.50. **6.** $1705.69 (balance). **7.** $1283.60 (balance). **8.** $3569.24 (balance). **9.** $7627.77 (balance). **10.** $2611.45 (balance). **11.** $4569.47 (balance).

Page **23.** **1.** $15.80. **2.** 97; 178. **3.** $3.80. **4.** 131. **5.** 50; 14. **6.** $3861.26.

Page **28.** **1.** $19.04. **2.** $83.76. **3.** $142.56. **4.** $169.32. **5.** $203.16. **6.** $15.27. **7.** $40.32. **8.** $151.20; 6.

Page **30.** **31.** 46. **32.** 55. **33.** 54. **34.** 60. **35.** 70. **36.** 55. **37.** 71. **38.** 69. **39.** 87. **40.** 78. **41.** 54. **42.** 47. **43.** 62. **44.** 62. **45.** 61. **46.** 79. **47.** 61. **48.** 88. **49.** 80. **50.** 89. **51.** 53. **52.** 60. **53.** 62. **54.** 48. **55.** 63. **56.** 78. **57.** 58. **58.** 68. **59.** 59. **60.** 71.

Page **31.** **1.** 3000; 1500; 750. **2.** 475,300. **3.** $175.50; $351.00; $702. **4.** $189.75. **5.** $900. **6.** $153,212.50. **7.** $13,260. **8.** $10,985. **9.** $14,790.72. **10.** $38,556. **11.** $1027.20. **12.** $4836.72.

Page **33.** **1.** 490; 4900; 49,000. **2.** $4.90; $49; $490. **3.** 574; 5740; 57,400. **4.** $5.74; $57.40; $574. **5.** 1018; 10,180; 101,800. **6.** $101.80; $1018; $10,180. **7.** 1654; 16,540; 165,400. **8.** $165.40; $1654; $16,540. **9.** 2046; 20,460; 204,600. **10.** $20.46; $204.60; $2046. **11.** 2175; 21,750; 217,500. **12.** $217.50; $2175; $21,750. **13.** 2799; 27,990; 279,900. **14.** $279.90; $2799; $27,990. **15.** 4920; 49,200; 492,000. **16.** $49.20; $492; $4920. **17.** 21,440; 214,400; 26,800; 268,000. **18.** $254; $2540; $317.50; $3175. **19.** 28,840; 288,400; 36,050; 360,500. **20.** $237.20; $2372; $296.50; $2965. **21.** 26,520; 265,200; 33,150; 331,500. **22.** $173.60; $1736; $217; $2170. **23.** 33,680; 336,800; 42,100; 421,000. **24.** $952.40; $9524; $1190.50; $11,905. **25.** $6611.85. **26.** $66,118.50.

27. $661,185. **28.** $712,610.50. **29.** $666,327.55. **30.** $7003.20. **31.** $70,032. **32.** $700,320. **33.** $707,323.20. **34.** $770,352. **35.** $4371.15. **36.** $43,711.50. **37.** $437,115. **38.** $441,486.15. **39.** $485,197.65. **40.** 1,108,800 ft. **41.** 1,993,760 ft. **42.** 248,200 ft. **43.** $4,861,080. **44.** $1,507,940. **45.** $1,863,000. **46.** $2,681,250. **47.** $1,223,133. **48.** $5,296,900.

Page 34. **1.** $2,218,900. **2.** $12. **3.** $38,610. **4.** $1656. **5.** $25.75. **6.** $186.80; $46.80. **7.** $259.50.

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28. 74,601; 107,406; 141,183; 54,918; 199,746. 135,694; 178,367; 69,382; 252,354. 256,802; 99,892; 363,324. 131,306; 477,582. 185,772.

29. 178,976; 78,208; 233,872; 241,392; 129,344. 99,008; 296,072; 305,592; 163,744. 129,376; 133,536; 71,552. 399,324; 213,968. 220,848.

30. 373,005; 72,495; 157,545; 153,495; 119,880. 164,859; 358,269; 349,059; 272,616. 69,631; 67,841; 52,984. 147,431; 115,144. 112,184.

31. 72,930; 142,103; 94,367; 109,616; 104,533. 212,190; 140,910; 163,680; 156,090. 274,561; 318,928; 304,139. 211,792; 210,971. 234,608.

32. 159,544; 324,184; 181,104; 226,184; 349,664. 336,589; 188,034; 234,839; 363,044. 382,074; 477,179; 737,684. 266,574; 412,104. 514,684.

33. 432,400; 425,820; 155,100; 300,800; 228,890. 833,520; 303,600; 588,800; 448,040. 298,980; 579,840; 441,222. 211,200; 160,710. 311,680.

34. 565,669; 297,648; 308,672; 556,023; 513,305. 354,672; 367,808; 662,547; 611,645. 193,536; 348,624; 321,840. 361,536; 333,760. 601,215.

35. 79,647; 290,511; 131,217; 279,624; 175,911. 70,473; 31,831; 67,832; 42,673. 116,103; 247,416; 155,649. 111,752; 70,303. 149,816.

36. 149,023; 199,628; 330,154; 139,251; 244,300. 244,244; 403,942; 170,373; 298,900. 541,112; 228,228; 400,400. 377,454; 662,200. 279,300.

37. 91,368; 98,415; 53,703; 95,256; 114,210; 167,427; 139,239; 84,807. 152,280; 83,096; 147,392; 176,720; 259,064; 215,448; 131,224. 89,505; 158,760; 190,350; 279,045; 232,065; 141,345. 86,632; 103,870; 152,269; 126,633; 77,129. 184,240; 270,088; 224,616; 136,808. 323,830; 269,310; 164,030. 394,797; 240,461. 199,977.

38. 146,132; 282,747; 101,310; 124,949; 282,440; 252,047; 42,673; 131,089. 438,396; 157,080; 193,732; 437,920; 390,796; 66,164; 203,252. 303,930; 374,847; 847,320; 756,141; 128,019; 393,267. 134,310; 303,600; 270,930; 45,870; 140,910. 374,440; 334,147; 56,573; 173,789. 755,320; 127,880; 392,840. 114,119; 350,567. 59,353.

39. 91,936; 79,118; 284,206; 365,534; 400,452; 190,944; 224,094; 252,824. 37,232; 133,744; 172,016; 188,448; 89,856; 105,456; 118,976. 115,097; 148,033; 162,170; 77,328; 90,753; 102,388. 531,761; 582,558; 277,776; 326,001; 367,796. 749,262; 357,264; 419,289; 473,044. 391,392; 459,342; 518,232. 219,024; 247,104. 290,004.

40. 361,382; 226,009; 248,087; 268,422; 191,730; 260,288; 133,049; 549,626. 241,958; 265,594; 287,364; 205,260; 278,656; 142,438; 588,412. 166,103; 179,718; 128,370; 174,272; 89,081; 367,994. 197,274; 140,910; 191,296; 97,783; 403,942. 152,460; 206,976; 105,798; 437,052. 147,840; 75,570; 312,180. 102,592; 423,808. 216,634.

41. 145,092; 85,654; 112,096; 130,402; 144,640; 182,382; 110,288; 90,174. 243,318; 318,432; 370,434; 410,880; 518,094; 313,296; 256,158. 187,984; 218,683; 242,560; 305,853; 184,952; 151,221. 286,192; 317,440; 400,272; 242,048; 197,904. 369,280; 465,639; 281,576; 230,223. 516,480; 312,320; 255,360. 393,816; 321,993. 194,712.

42. 282,768; 243,312; 388,806; 733,224; 400,314; 612,390; 252,354; 575,400. 101,824; 162,712; 306,848; 167,528; 256,280; 105,608; 240,800. 140,008; 264,032; 144,152; 220,520; 90,872; 207,200. 421,916; 230,351; 352,385; 145,211; 331,100. 434,404; 664,540; 273,844; 624,400. 362,815; 149,509; 340,900. 228,715; 521,500; 214,900.

Page **45.** **1.** 31. **2.** 59. **3.** 86. **4.** 84; 60. **5.** 393; 400 lb. **6.** 6; $250. **7.** 42; $1000. **8.** 20. **9.** 30. **10.** 10. **11.** 189. **12.** 181. **13.** 231. **14.** 146. **15.** $57\frac{1000}{4000}$. **16.** $149\frac{500}{5000}$. **17.** 91.

Page **47.** **1.** 42. **2.** 24. **3.** 38. **4.** 42. **5.** 66. **6.** 37. **7.** 48. **8.** 56. **9.** 82. **10.** 75. **11.** 43. **12.** 66. **13.** 77. **14.** 37. **15.** 99. **16.** 33. **17.** 42. **18.** 53. **19.** 72. **20.** 37. **21.** 68. **22.** 98. **23.** 42. **24.** 77. **25.** 79. **26.** 88. **27.** 89. **28.** 82. **29.** 66. **30.** 38. **31.** 46. **32.** 90. **33.** 62. **34.** 360. **35.** 35. **36.** 124. **37.** 79. **38.** 89. **39.** 94. **40.** 76. **41.** 87. **42.** 99. **43.** $78\frac{20}{69}$. **44.** $108\frac{9}{68}$. **45.** 110. **46.** $46\frac{11}{95}$. **47.** $39\frac{26}{79}$. **48.** $71\frac{57}{87}$. **49.** $57\frac{43}{76}$. **50.** $106\frac{23}{78}$. **51.** $316\frac{3}{19}$.

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36. $18\frac{10}{25}$. **37.** $21\frac{8}{22}$. **38.** $11\frac{9}{11}$. **39.** $6\frac{6}{24}$. **40.** $13\frac{10}{30}$. **41.** $10\frac{2}{22}$. **42.** $14\frac{14}{22}$. **43.** $20\frac{2}{16}$. **44.** $4\frac{28}{32}$. **45.** 10. **46.** $3\frac{27}{81}$. **47.** 10. **48.** 20. **49.** 4. **50.** $3\frac{75}{225}$. **51.** 3. **52.** 2. **53.** $3\frac{50}{225}$. **54.** $3\frac{100}{225}$.

Page **52.** **1.** \$7. **2.** \$71. **3.** \$32. **4.** \$6. **5.** \$6.75. **6.** \$43. **7.** \$1.10. **8.** \$1.50. **9.** \$27. **10.** \$29.54; \$206.78; \$827.12. **11.** \$82.50; \$330.00. **12.** \$130; \$650; \$910; \$390; \$1040. **13.** \$152. **14.** 33¢. **15.** \$455. **16.** 479; 10. **17.** 38.

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Page **57.** **1.** \$194.32. **2.** \$185.25. **3.** \$1137.50. **4.** \$508.25. **5.** \$79.52. **6.** \$62.40. **7.** \$26.25. **8.** \$3532.50. **9.** \$2019.60. **10.** \$751.50. **11.** \$91,264.80. **12.** \$304.30.

Page **58.** **1.** 572. **2.** \$170,000. **3.** 29¢. **4.** 49 mi. **5.** 18. **6.** 22¢. **7.** 1,743,414. **8.** \$811,296.30.

Page **65.** **1.** $\frac{5}{8}$. **2.** $\frac{7}{8}$. **3.** $\frac{1}{4}$. **4.** $\frac{5}{7}$. **5.** $\frac{5}{6}$. **6.** $\frac{2}{3}$. **7.** $\frac{7}{15}$. **8.** $\frac{11}{16}$. **9.** $\frac{2}{3}$. **10.** $\frac{1}{6}$. **11.** $\frac{1}{8}$. **12.** $\frac{5}{8}$. **13.** $\frac{27}{160}$. **14.** $\frac{11}{16}$. **15.** $\frac{7}{8}$. **16.** $\frac{9}{32}$. **17.** 1. **18.** $\frac{9}{16}$.

Page **66.** **15.** $\frac{1}{2}$. **16.** $\frac{1}{2}$. **17.** $\frac{2}{2}$. **18.** $\frac{4}{2}$. **19.** $\frac{6}{2}$. **20.** $\frac{3}{2}$. **21.** $\frac{2}{4}$. **22.** $\frac{12}{4}$. **23.** $\frac{9}{4}$. **24.** $\frac{12}{4}$. **25.** $\frac{14}{4}$. **26.** $\frac{16}{4}$. **27.** $\frac{6}{8}$. **28.** $\frac{8}{8}$. **29.** $\frac{20}{8}$. **30.** $\frac{28}{8}$. **31.** $\frac{2}{8}$. **32.** $\frac{4}{8}$. **33.** $\frac{4}{12}$. **34.** $\frac{9}{12}$. **35.** $\frac{8}{12}$. **36.** $\frac{14}{12}$. **37.** $\frac{18}{12}$. **38.** $\frac{2}{12}$. **39.** $\frac{1}{2}$. **40.** $\frac{2}{3}$. **41.** $\frac{1}{3}$. **42.** $\frac{3}{5}$. **43.** $\frac{1}{3}$. **44.** $\frac{2}{5}$. **45.** $\frac{4}{5}$. **46.** $\frac{9}{13}$. **47.** $\frac{3}{4}$. **48.** $\frac{4}{7}$. **49.** $\frac{1}{2}$. **50.** $\frac{1}{3}$. **51.** $\frac{3}{5}$. **52.** $\frac{37}{41}$. **53.** $\frac{13}{14}$. **54.** $\frac{8}{9}$. **55.** $\frac{5}{9}$. **56.** $\frac{11}{20}$.

Page **67.** **1.** $\frac{3}{8}$, $\frac{14}{32}$, $\frac{8}{16}$, $\frac{5}{8}$, $\frac{3}{4}$. **2.** $\frac{2}{3}$ yd. **3.** $\frac{7}{8}$ in.; no; no. **4.** $\frac{2}{8}$ in.; $\frac{4}{16}$ in.; $\frac{1}{4}$. **5.** $\frac{5}{32}$ in. **6.** $\frac{28}{64}$. **7.** $\frac{36}{64}$. **8.** $\frac{18}{64}$. **9.** $\frac{30}{64}$. **10.** $\frac{32}{64}$. **11.** $\frac{6}{64}$. **12.** $\frac{24}{36}$. **13.** $\frac{27}{36}$. **14.** $\frac{4}{36}$. **15.** $\frac{6}{36}$. **16.** $\frac{20}{36}$. **17.** $\frac{18}{36}$. **18.** $\frac{14}{24}$. **19.** $\frac{8}{24}$. **20.** $\frac{1}{24}$. **21.** $\frac{3}{24}$. **22.** $\frac{10}{24}$. **23.** $\frac{22}{24}$.

Page **68.** **4.** $\frac{4}{4}$; $\frac{5}{4}$; $\frac{7}{4}$; $\frac{8}{4}$. **5.** $\frac{5}{5}$; $\frac{6}{5}$; $\frac{7}{5}$. **6.** $\frac{6}{6}$; $\frac{7}{6}$; $\frac{11}{6}$; $\frac{12}{6}$; $\frac{13}{6}$; $\frac{17}{6}$; $\frac{18}{6}$. **7.** $\frac{8}{7}$; $\frac{16}{7}$; $\frac{22}{7}$. **8.** $\frac{8}{8}$; $\frac{16}{8}$; $\frac{17}{8}$. **9.** $\frac{10}{9}$; $\frac{20}{9}$; $\frac{27}{9}$. **10.** $\frac{33}{10}$; $\frac{37}{10}$; $\frac{40}{10}$. **11.** $\frac{12}{12}$; $\frac{24}{12}$; $\frac{36}{12}$; $\frac{48}{12}$; $\frac{25}{12}$; $\frac{41}{12}$; $\frac{55}{12}$; $\frac{59}{12}$. **12.** $\frac{16}{16}$; $\frac{32}{16}$; $\frac{48}{16}$; $\frac{64}{16}$; $\frac{17}{16}$; $\frac{19}{16}$; $\frac{33}{16}$; $\frac{37}{16}$; $\frac{55}{16}$; $\frac{73}{16}$.

Page 69. 1. 31; 33; 39; 22. 2. 27; 39. 3. $\frac{16}{8}$. 4. $\frac{9}{3}$. 5. $\frac{3}{2}$. 6. $\frac{19}{5}$. 7. $\frac{11}{3}$. 8. $\frac{29}{6}$. 9. $\frac{28}{9}$. 10. $\frac{13}{5}$. 11. $\frac{10}{3}$. 12. $\frac{22}{5}$. 13. $\frac{49}{9}$. 14. $\frac{33}{5}$. 15. $\frac{23}{3}$. 16. $\frac{77}{9}$. 17. $\frac{29}{9}$. 18. $\frac{320}{10}$. 19. $\frac{13}{4}$. 20. $\frac{53}{8}$. 21. $\frac{19}{4}$. 22. $\frac{41}{8}$. 23. $\frac{55}{8}$. 24. $\frac{55}{6}$. 25. $\frac{128}{2}$. 26. $\frac{33}{5}$.

Page 70. 3. 2. 4. 3. 5. 4. 6. $3\frac{1}{2}$. 7. 5. 8. $5\frac{1}{2}$. 9. 2. 10. $2\frac{1}{4}$. 11. 10. 12. 5. 13. 6. 14. $7\frac{1}{2}$. 15. 10. 16. 5. 17. $13\frac{1}{3}$. 18. $6\frac{2}{3}$. 19. 11. 20. 11. 21. $8\frac{4}{5}$. 22. $5\frac{1}{2}$. 23. $10\frac{1}{8}$. 24. $7\frac{2}{3}$. 25. $2\frac{3}{8}$. 26. $3\frac{1}{8}$. 27. \$7.25; \$7.75. 28. \$12; \$12.50.

Page 78. 7. $\frac{9}{16}$ in. 8. $\frac{7}{32}$ in. 9. $\frac{31}{32}$ in. 10. $\frac{41}{64}$ in. 11. $1\frac{1}{24}$. 12. $1\frac{7}{24}$. 13. $\frac{31}{48}$. 14. $1\frac{17}{48}$. 15. $\frac{37}{48}$. 16. $\frac{43}{48}$. 17. $\frac{29}{48}$. 18. $\frac{31}{48}$. 19. 2 in. 20. $\frac{7}{8}$. 21. $1\frac{3}{8}$. 22. $\frac{2}{3}$. 23. $1\frac{1}{2}$. 24. $\frac{13}{24}$. 25. $1\frac{3}{8}$.

Page 79. 1. $1\frac{3}{4}$ yd. 2. $82\frac{1}{2}$. 3. $15\frac{1}{2}$ in.

Page 80. 1. $1\frac{1}{4}$. 2. $\frac{7}{8}$. 3. $1\frac{3}{8}$. 4. $1\frac{1}{8}$. 5. $\frac{5}{8}$. 6. $\frac{3}{8}$. 7. $\frac{7}{8}$. 8. $\frac{5}{8}$. 9. $\frac{7}{8}$. 10. $1\frac{5}{8}$. 11. $3\frac{3}{8}$. 12. $6\frac{1}{8}$. 13. $5\frac{7}{8}$. 14. $7\frac{5}{8}$. 15. $5\frac{7}{8}$. 16. $6\frac{3}{8}$. 17. $6\frac{5}{8}$. 18. $3\frac{9}{16}$. 19. $5\frac{13}{16}$. 20. $6\frac{1}{16}$. 21. $9\frac{3}{16}$. 22. $6\frac{5}{16}$. 23. $8\frac{9}{16}$. 24. $8\frac{7}{16}$. 25. $7\frac{13}{16}$. 26. $2\frac{5}{6}$. 27. $6\frac{1}{6}$. 28. $6\frac{1}{12}$. 29. $6\frac{5}{12}$. 30. $6\frac{13}{24}$. 31. 5. 32. $6\frac{1}{2}$. 33. 6. 34. $8\frac{1}{4}$. 35. 15. 36. $48\frac{3}{4}$. 37. $42\frac{1}{3}$. 38. $33\frac{5}{12}$. 39. $26\frac{17}{24}$. 40. $28\frac{3}{8}$. 41. $38\frac{7}{16}$. 42. $18\frac{11}{16}$. 43. $3\frac{7}{8}$. 44. $4\frac{2}{3}$. 45. $4\frac{7}{24}$. 46. $9\frac{7}{8}$. 47. 6. 48. $6\frac{7}{16}$. 49. $9\frac{11}{16}$. 50. $14\frac{3}{16}$. 51. $11\frac{1}{16}$.

Page 81. 1. $\frac{1}{8}$ yd. 2. $\frac{3}{8}$ mi. 3. $11\frac{1}{8}$ in. 4. $15\frac{1}{2}$ in. 5. $44\frac{1}{4}$ mi. 6. $5\frac{1}{8}$ gal.

Page 82. 1. $22\frac{1}{2}$ in. 2. $2\frac{7}{16}$ in. 3. $2\frac{3}{8}$ in. 4. $2\frac{1}{4}$. 5. $5\frac{5}{8}$. 6. $5\frac{1}{6}$. 7. $1\frac{3}{4}$. 8. $7\frac{5}{8}$. 9. $5\frac{5}{8}$. 10. $1\frac{3}{4}$. 11. $3\frac{3}{8}$. 12. $1\frac{1}{40}$. 13. $1\frac{5}{6}$. 14. $2\frac{5}{8}$. 15. $1\frac{7}{12}$. 16. $1\frac{1}{12}$. 17. $6\frac{13}{15}$. 18. $1\frac{23}{40}$. 19. $3\frac{1}{4}$. 20. $1\frac{3}{4}$. 21. $2\frac{1}{4}$. 22. $4\frac{5}{8}$. 23. $5\frac{3}{8}$. 24. $4\frac{7}{12}$. 25. $7\frac{13}{24}$. 26. $8\frac{13}{16}$. 27. $7\frac{3}{16}$.

Page 83. 1. $12\frac{1}{2}$. 2. $16\frac{1}{3}$. 3. $12\frac{1}{3}$. 4. $15\frac{7}{10}$. 5. $12\frac{15}{16}$. 6. $19\frac{8}{9}$. 7. $21\frac{7}{16}$. 8. $23\frac{3}{4}$. 9. $33\frac{7}{24}$. 10. $28\frac{1}{2}$. 11. $30\frac{39}{40}$. 12. $25\frac{3}{4}$. 13. $18\frac{4}{5}$. 14. $\frac{5}{8}$. 15. $\frac{9}{16}$. 16. $\frac{5}{12}$. 17. $\frac{5}{6}$. 18. $\frac{1}{3}$. 19. $\frac{1}{6}$. 20. $\frac{1}{6}$. 21. $\frac{1}{30}$. 22. $\frac{1}{10}$. 23. $\frac{1}{8}$. 24. $\frac{5}{24}$. 25. $\frac{1}{6}$. 26. $1\frac{1}{6}$. 27. $2\frac{7}{8}$. 28. $1\frac{3}{5}$. 29. $1\frac{3}{8}$. 30. $1\frac{1}{4}$. 31. $\frac{3}{4}$. 32. $1\frac{1}{8}$. 33. $\frac{7}{8}$. 34. $12\frac{1}{8}$. 35. $2\frac{7}{8}$. 36. $10\frac{1}{6}$. 37. $18\frac{5}{6}$.

Page 84. 1. $6\frac{1}{4}$. 2. $6\frac{1}{8}$. 3. $1\frac{3}{4}$. 4. $9\frac{1}{8}$. 5. $11\frac{9}{16}$. 6. $29\frac{1}{12}$. 7. $4\frac{1}{8}$. 8. $5\frac{3}{8}$. 9. $3\frac{1}{4}$. 10. $3\frac{7}{8}$. 11. $3\frac{5}{16}$. 12. $1\frac{9}{16}$. 13. $3\frac{5}{8}$. 14. $5\frac{1}{2}$. 15. $\frac{1}{8}$. 16. $\frac{11}{30}$. 17. $2\frac{13}{16}$. 18. $3\frac{1}{16}$. 19. $3\frac{11}{12}$. 20. $3\frac{7}{12}$. 21. $2\frac{11}{32}$. 22. $2\frac{31}{32}$. 23. $2\frac{1}{6}$. 24. $6\frac{1}{2}$. 25. $20\frac{2}{15}$. 26. $27\frac{13}{15}$. 27. $4\frac{7}{8}$. 28. $13\frac{5}{8}$. 29. $4\frac{7}{16}$. 30. $14\frac{1}{16}$. 31. $81\frac{3}{4}$ in. 32. $19\frac{5}{6}$. 33. $34\frac{1}{3}$. 34. $25\frac{7}{8}$. 35. $26\frac{5}{24}$. 36. 113.

Page 85. 1. $1\frac{1}{2}$. 2. $2\frac{1}{2}$. 3. $3\frac{1}{2}$. 4. $4\frac{1}{2}$. 5. $5\frac{1}{2}$. 6. $7\frac{1}{2}$. 7. $3\frac{1}{3}$. 8. $3\frac{2}{3}$. 9. $4\frac{1}{3}$. 10. $4\frac{2}{3}$. 11. $8\frac{2}{3}$. 12. $6\frac{2}{3}$. 13. $14\frac{2}{3}$. 14. $9\frac{1}{3}$. 15. $3\frac{1}{3}$. 16. $4\frac{2}{3}$. 17. $5\frac{1}{3}$. 18. $1\frac{1}{4}$. 19. $1\frac{3}{4}$. 20. $2\frac{1}{4}$. 21. $2\frac{3}{4}$. 22. $3\frac{1}{4}$. 23. $3\frac{3}{4}$. 24. $4\frac{1}{4}$. 25. $8\frac{1}{4}$. 26. $9\frac{3}{4}$. 27. $11\frac{1}{4}$. 28. $15\frac{3}{4}$. 29. $\frac{3}{8}$. 30. $1\frac{1}{8}$. 31. $1\frac{1}{2}$. 32. $2\frac{1}{4}$. 33. $1\frac{7}{8}$. 34. $2\frac{5}{8}$. 35. $\frac{5}{8}$. 36. $1\frac{7}{8}$. 37. $3\frac{1}{8}$. 38. $4\frac{3}{8}$. 39. $1\frac{3}{8}$. 40. $4\frac{1}{8}$. 41. $6\frac{7}{8}$. 42. $9\frac{5}{8}$.

Page 86. 29. 5. 30. 3 yd. 31. $\frac{1}{6}$; 3. 32. 18. 33. 4. 34. $4\frac{1}{2}$. 35. $5\frac{1}{4}$. 36. 4. 37. $5\frac{1}{3}$. 38. 6. 39. $4\frac{1}{2}$. 40. 3. 41. 6. 42. $6\frac{3}{4}$. 43. $2\frac{5}{8}$. 44. 3. 45. $1\frac{7}{8}$. 46. $3\frac{1}{8}$. 47. $4\frac{1}{6}$. 48. $3\frac{3}{4}$. 49. $4\frac{3}{8}$. 50. $6\frac{1}{8}$. 51. 7. 52. $7\frac{7}{8}$. 53. $3\frac{1}{2}$. 54. $1\frac{3}{4}$. 55. 9. 56. 8.

57. $7\frac{1}{5}$. **58.** $4\frac{1}{2}$. **59.** 6. **60.** 12. **61.** $9\frac{3}{5}$. **62.** 12. **63.** 15. **64.** $11\frac{1}{4}$. **65.** $15\frac{3}{4}$. **66.** 12. **67.** 8. **68.** 16. **69.** 18. **70.** 9. **71.** $31\frac{1}{2}$. **72.** $7\frac{1}{2}$. **73.** 10. **74.** $15\frac{3}{4}$. **75.** $13\frac{1}{8}$. **76.** 21. **77.** 45. **78.** 18. **79.** 22. **80.** 11. **81.** 2. **82.** 22. **83.** 30. **84.** 75.

Page 88. **1.** 3. **2.** 5. **3.** 6. **4.** 4. **5.** 20. **6.** 30. **7.** 21. **8.** $34\frac{7}{8}$. **9.** 20. **10.** 12. **11.** 44. **12.** 48. **13.** 30. **14.** 70. **15.** 168. **16.** 42. **17.** $55\frac{1}{2}$ mi.; $83\frac{1}{4}$ mi.; $138\frac{3}{4}$ mi. **18.** 84. **19.** 132. **20.** 324. **21.** 235. **22.** 198. **23.** 148. **24.** 260. **25.** 335. **26.** 498. **27.** 315. **28.** 504. **29.** 567.

Page 90. **1.** 36; 27. **2.** $4\frac{1}{2}$. **3.** 24. **4.** $1.50. **5.** 40¢; 20¢; 60¢; 10¢; 50¢. **6.** 54¢. **7.** 45¢. **8.** 63¢. **9.** 76¢. **10.** 126; 42. **11.** 480. **12.** 140. **13.** 645. **14.** 791. **15.** 861. **16.** 2110. **17.** 1465. **18.** 1866. **19.** 2121. **20.** 4005. **21.** 549. **22.** 2863. **23.** 6470. **24.** 720. **25.** 2160.

Page 91. **1.** 90¢; $1.50; $2.10. **2.** $67\frac{1}{2}$. **3.** $24\frac{1}{2}$. **4.** $42\frac{2}{3}$. **5.** 24. **6.** $233\frac{1}{3}$. **7.** 645. **8.** 207. **9.** 52. **10.** 76. **11.** 161. **12.** 100. **13.** 108. **14.** 148. **15.** 376. **16.** 567. **17.** 75. **18.** 93. **19.** 342. **20.** 891. **21.** 230. **22.** 548. **23.** 682.

Page 94. **7.** $\frac{1}{6}$. **8.** $\frac{1}{6}$. **9.** $\frac{1}{3}$. **10.** $\frac{1}{3}$. **11.** $\frac{1}{8}$. **12.** $\frac{3}{8}$. **13.** $\frac{1}{4}$. **14.** $\frac{1}{2}$. **15.** $\frac{1}{16}$. **16.** $\frac{3}{16}$. **17.** $\frac{5}{16}$. **18.** $\frac{1}{8}$. **19.** $\frac{1}{4}$. **20.** $\frac{5}{12}$. **21.** $\frac{7}{12}$. **22.** $\frac{1}{5}$. **23.** $\frac{1}{8}$. **24.** $\frac{1}{16}$. **25.** $\frac{1}{32}$. **26.** $\frac{3}{32}$. **27.** $\frac{15}{32}$. **28.** $\frac{21}{32}$. **29.** $\frac{1}{32}$. **30.** $\frac{3}{32}$. **31.** $\frac{1}{8}$ hr.; $\frac{1}{12}$ hr. **32.** $\frac{15}{32}$ min. **33.** $\frac{1}{2}$. **34.** $\frac{5}{8}$. **35.** $\frac{1}{2}$ mi. **36.** $\frac{5}{16}$ yd. **37.** $\frac{49}{96}$. **38.** $\frac{7}{24}$ mi.; $\frac{7}{48}$ mi. **39.** $1\frac{9}{40}$ yd. **40.** $\frac{1}{4}$; $\frac{1}{8}$. **41.** $\frac{1}{10}$. **42.** $\frac{1}{2}$. **43.** $\frac{1}{3}$. **44.** $\frac{1}{3}$. **45.** $\frac{21}{64}$. **46.** $\frac{2}{5}$. **47.** $\frac{3}{5}$. **48.** $\frac{5}{8}$. **49.** $\frac{5}{32}$. **50.** $\frac{3}{8}$. **51.** $\frac{5}{16}$. **52.** $\frac{1}{6}$.

Page 96. **1.** $6\frac{3}{8}$. **2.** $2\frac{13}{16}$ lb. **3.** $4\frac{1}{3}$ in. **4.** $2\frac{11}{32}$ ft. **5.** $4\frac{13}{32}$ in. **6.** $1\frac{25}{32}$ yd. **7.** $8\frac{7}{8}$ mi. **8.** 17 mi. **9.** $1\frac{13}{16}$ in. **10.** $8\frac{1}{16}$ lb. **11.** $5\frac{13}{16}$ in. **12.** $11\frac{5}{8}$ yd. **13.** $7\frac{19}{32}$ yd. **14.** $9\frac{27}{32}$ mi. **15.** $15\frac{5}{16}$ mi. **16.** $6\frac{1}{4}$ ft. **17.** $12\frac{1}{8}$ ft.

Page 97. **1.** $3\frac{3}{4}$. **2.** $8\frac{3}{4}$. **3.** $12\frac{1}{4}$. **4.** $5\frac{5}{8}$. **5.** $9\frac{3}{8}$. **6.** $4\frac{2}{3}$. **7.** $16\frac{1}{3}$. **8.** $6\frac{3}{16}$. **9.** $9\frac{3}{16}$. **10.** $9\frac{1}{32}$. **11.** $12\frac{21}{32}$. **12.** $43\frac{27}{32}$. **13.** $18\frac{29}{32}$. **14.** $16\frac{1}{24}$. **15.** $21\frac{13}{24}$. **16.** $9\frac{11}{12}$. **17.** $8\frac{17}{18}$. **18.** $17\frac{13}{18}$. **19.** $7\frac{3}{4}$. **20.** $23\frac{13}{20}$. **21.** $19\frac{19}{20}$. **22.** $24\frac{13}{20}$. **23.** 13. **24.** $7\frac{11}{15}$. **25.** $4\frac{9}{40}$. **26.** $9\frac{3}{40}$. **27.** $21\frac{3}{8}$. **28.** $39\frac{27}{40}$. **29.** $9\frac{1}{16}$. **30.** $22\frac{73}{80}$. **31.** $3\frac{19}{24}$. **32.** $11\frac{23}{24}$. **33.** $4\frac{11}{16}$. **34.** $9\frac{19}{48}$. **35.** $20\frac{15}{16}$. **36.** $2\frac{21}{32}$. **37.** $7\frac{21}{32}$. **38.** $7\frac{7}{64}$. **39.** $25\frac{15}{64}$. **40.** $19\frac{9}{64}$. **41.** $19\frac{49}{64}$. **42.** $3\frac{41}{48}$.

Page 98. **1.** $57.36. **2.** $45.01. **3.** $21.99. **4.** $26.55. **5.** $14.03. **6.** $2.64; $4.99; $3.01; $3.45; $5.97.

Page 99. **1.** Four million two hundred one thousand seven hundred two; sixteen hundred six. **2.** 19,000,006. **3.** 121,823. **4.** $473.82. **5.** $853.76. **6.** 177,313,576. **7.** $528,272. **8.** 545. **9.** 2566; 1565. **10.** $\frac{3}{4}$, $\frac{3}{4}$, $\frac{1}{2}$, $\frac{9}{16}$, $\frac{3}{4}$, 1. **11.** $\frac{28}{4}$; $\frac{29}{4}$; $\frac{39}{4}$. **12.** $\frac{103}{4}$; $\frac{206}{8}$. **13.** 17, $11\frac{3}{4}$, $7\frac{5}{8}$. **14.** $24\frac{1}{4}$. **15.** $\frac{7}{8}$ in. **16.** 7; 4 in. **17.** 265,625. **18.** 768,912. **19.** 144. **20.** 216. **21.** $\frac{3}{8}$. **22.** $8\frac{3}{4}$. **23.** $52\frac{1}{16}$. **24.** 129. **25.** $\frac{15}{64}$. **26.** $28\frac{7}{16}$. **27.** $78\frac{3}{8}$. **28.** $44\frac{19}{64}$.

Page 102. **1.** $7\frac{1}{2}$. **2.** $6\frac{3}{4}$. **3.** 48 in. **4.** 5. **5.** $31\frac{1}{2}$. **6.** $\frac{5}{8}$. **7.** $\frac{3}{4}$; $\frac{3}{8}$; $\frac{9}{16}$. **8.** $2\frac{1}{4}$ min.; $4\frac{11}{40}$ min.; $4\frac{29}{40}$ min. **9.** $36.17.

Page 103. **1.** 48. **2.** \$9. **3.** \$2.58. **4.** \$6.80. **5.** \$20.00.

Page 104. I. **1.** 1631. **2.** 104,119. **3.** $1040\frac{7}{8}$. **4.** $552\frac{7}{8}$. **5.** 279. **6.** 8050. **7.** $\frac{9}{32}$. **8.** $9\frac{9}{16}$.

II. **1.** 1596. **2.** 1,236,442. **3.** 313,429. **4.** 293,501,180. **5.** $6\frac{3}{8}$. **6.** $\frac{5}{8}$. **7.** $10\frac{1}{16}$. **8.** $52\frac{11}{80}$.

III. **1.** 1296. **2.** 299,465. **3.** 365,241. **4.** 579,106,080. **5.** $81\frac{7}{8}$. **6.** $62\frac{1}{8}$. **7.** 711. **8.** $715\frac{15}{16}$.

IV. **1.** 184. **2.** 992,311. **3.** 872,986. **4.** \$324,084.75. **5.** $215\frac{5}{8}$. **6.** $29\frac{7}{8}$. **7.** $1\frac{1}{8}$. **8.** $222\frac{13}{16}$.

V. **1.** $\frac{26}{3}$. **2.** $14\frac{1}{8}$. **3.** $16\frac{1}{8}$. **4.** $363\frac{3}{8}$. **5.** $3\frac{1}{4}$. **6.** $4\frac{1}{8}$. **7.** $12\frac{1}{4}$. **8.** $613\frac{29}{40}$.

VI. **1.** 5. **2.** $19\frac{3}{8}$. **3.** $4\frac{11}{12}$. **4.** $1250\frac{5}{8}$. **5.** \$8.12. **6.** $14\frac{13}{16}$ ft. **7.** $6\frac{7}{8}$ in. **8.** $9679\frac{1}{8}$.

Page 107. **1.** $\frac{1}{6}$. **2.** $2\frac{5}{8}$. **3.** $1\frac{11}{16}$ yd. **4.** $\frac{5}{16}$. **5.** $\frac{5}{16}$; $\frac{5}{8}$. **6.** $22\frac{1}{2}$ mi. **7.** $\frac{1}{4}$. **8.** $\frac{1}{6}$. **9.** $\frac{1}{5}$. **10.** $\frac{5}{16}$. **11.** $\frac{1}{5}$. **12.** $\frac{2}{5}$. **13.** $\frac{1}{8}$. **14.** $\frac{3}{8}$. **15.** $\frac{1}{6}$. **16.** $\frac{1}{3}$. **17.** $\frac{2}{5}$. **18.** $\frac{5}{24}$. **19.** $\frac{5}{32}$. **20.** $\frac{3}{32}$. **21.** $\frac{1}{16}$. **22.** $\frac{2}{5}$. **23.** $\frac{1}{8}$. **24.** $\frac{1}{12}$. **25.** $\frac{1}{16}$. **26.** $\frac{7}{24}$. **27.** $\frac{7}{32}$. **28.** $\frac{1}{8}$. **29.** $\frac{1}{8}$. **30.** $\frac{1}{12}$. **31.** $9\frac{1}{6}$. **32.** $14\frac{3}{4}$. **33.** $12\frac{1}{5}$. **34.** $3\frac{1}{8}$. **35.** $6\frac{1}{5}$. **36.** $5\frac{3}{4}$. **37.** $15\frac{3}{16}$. **38.** $26\frac{9}{10}$.

Page 108. **1.** 16; 32; 3; 10. **2.** 412. **3.** 1728. **4.** 256. **5.** 384. **6.** 180. **7.** 288. **8.** 576. **9.** $2\frac{1}{2}$. **10.** 1. **11.** 3. **12.** 7. **13.** 4. **14.** 12. **15.** 29. **16.** 57. **17.** 118. **18.** 83. **19.** 66. **20.** 88. **21.** 188. **22.** 168. **23.** 248.

Page 110. **1.** $1\frac{5}{16}$; $\frac{16}{21}$. **2.** $1\frac{1}{9}$; $\frac{9}{10}$. **3.** $\frac{9}{20}$; $2\frac{2}{9}$. **4.** $3\frac{1}{8}$; $\frac{8}{25}$. **5.** $1\frac{1}{24}$; $\frac{24}{25}$. **6.** $\frac{1}{2}$; 2. **7.** $1\frac{1}{5}$; $\frac{5}{6}$. **8.** $1\frac{1}{3}$; $\frac{3}{4}$. **9.** $1\frac{1}{8}$; $\frac{8}{9}$. **10.** $\frac{10}{21}$; $2\frac{1}{10}$. **11.** $\frac{9}{10}$; $1\frac{1}{9}$. **12.** $4\frac{2}{3}$; $\frac{3}{14}$. **13.** $\frac{5}{14}$; $2\frac{4}{5}$. **14.** $1\frac{1}{5}$; $\frac{5}{6}$. **15.** $\frac{5}{16}$; $3\frac{1}{5}$. **16.** $\frac{1}{4}$; 4. **17.** 12; 12; 28. **18.** 13. **19.** 19. **20.** 32. **21.** 16. **22.** 20.

Page 111. **1.** 9; 9. **2.** 5. **3.** 12; $25\frac{1}{2}$; 54. **4.** 2. **5.** 2. **6.** $1\frac{1}{5}$. **7.** 3. **8.** 2. **9.** 2. **10.** 3. **11.** $2\frac{2}{27}$. **12.** $\frac{8}{13}$. **13.** $\frac{6}{7}$. **14.** $1\frac{7}{8}$. **15.** $\frac{3}{8}$. **16.** 6. **17.** 12. **18.** $\frac{34}{49}$. **19.** $1\frac{13}{54}$. **20.** $\frac{54}{67}$. **21.** 4. **22.** 4. **23.** 7. **24.** $1\frac{2}{3}$.

Page 113. **7.** $\frac{1}{8}$. **8.** $\frac{1}{4}$; $\frac{1}{3}$; $\frac{1}{2}$. **9.** $\frac{1}{4}$. **10.** $\frac{1}{5}$. **11.** $\frac{1}{8}$. **12.** $\frac{1}{3}$. **13.** $\frac{1}{4}$. **14.** $\frac{1}{5}$. **15.** $\frac{1}{2}$. **16.** $\frac{1}{4}$. **17.** $\frac{1}{7}$.

Page 114. **1.** $\frac{1}{2}$. **2.** $\frac{1}{4}$. **3.** $\frac{8}{9}$. **4.** $\frac{6}{7}$. **5.** $\frac{8}{15}$. **6.** $\frac{1}{6}$. **7.** $\frac{3}{10}$. **8.** $\frac{5}{14}$. **9.** $\frac{1}{3}$. **10.** $\frac{2}{3}$. **11.** $\frac{3}{4}$. **12.** $\frac{1}{4}$. **13.** $\frac{1}{3}$. **14.** $\frac{20}{27}$. **15.** $\frac{2}{3}$. **16.** $\frac{3}{4}$. **17.** $\frac{7}{8}$. **18.** $\frac{5}{16}$. **19.** $\frac{9}{16}$. **20.** $\frac{1}{2}$; $\frac{3}{4}$. **21.** 1. **22.** $4\frac{4}{9}$. **23.** $\frac{13}{30}$. **24.** 1. **25.** 7245. **26.** 24,990. **27.** 211,200. **28.** 1824.

Page 115. **1.** 1. **2.** $\frac{5}{6}$. **3.** 5. **4.** $5\frac{5}{6}$. **5.** $5\frac{5}{8}$. **6.** 7. **7.** $6\frac{5}{12}$. **8.** $7\frac{1}{2}$. **9.** $\frac{3}{8}$. **10.** $\frac{1}{12}$. **11.** $\frac{7}{8}$. **12.** $3\frac{7}{20}$. **13.** $2\frac{1}{6}$. **14.** $\frac{19}{24}$. **15.** $2\frac{7}{8}$. **16.** $2\frac{5}{8}$. **17.** 10. **18.** $7\frac{3}{4}$. **19.** 22. **20.** $7\frac{7}{9}$. **21.** $8\frac{5}{16}$. **22.** 15. **23.** $9\frac{11}{16}$. **24.** $10\frac{5}{8}$. **25.** $3\frac{1}{8}$. **26.** 2. **27.** $3\frac{1}{2}$. **28.** 3. **29.** $1\frac{3}{14}$. **30.** $\frac{3}{14}$. **31.** $\frac{19}{22}$. **32.** $3\frac{2}{9}$. **33.** 32. **34.** $1\frac{31}{32}$ in. **35.** 2 mi.

Page 116. **1.** 159. **2.** $192\frac{1}{2}$ mi. **3.** \$1.68. **4.** \$1.20. **5.** $4\frac{1}{2}$ hr. **6.** $609\frac{3}{13}$. **7.** \$1.25. **8.** \$2.80; \$14.00. **9.** 12. **10.** \$1.20. **11.** \$8.71.

Page 118. **6.** $\frac{2}{5}$; 0.4. **7.** $\frac{3}{5}$; 0.6. **8.** $\frac{7}{10}$; 0.7. **9.** $\frac{9}{10}$; 0.9. **10.** $\frac{1}{20}$; 0.05. **11.** $\frac{7}{100}$; 0.07. **12.** $\frac{1}{4}$; 0.25. **13.** $\frac{31}{50}$; 0.62.

Page 120. **36.** 0.03. **37.** 0.07. **38.** 1.3. **39.** 2.7. **40.** 0.26. **41.** 0.9. **42.** 0.09. **43.** 0.19. **44.** 0.019. **45.** 0.195.

Page 122. **1.** $19.96. **2.** $17.70. **3.** 91.95. **4.** 31.88. **5.** 111.71. **6.** 60.14. **7.** 28.29. **8.** 46.62. **9.** 36.36. **10.** 38.44. **11.** 197.37. **12.** 264.06. **13.** 20.347. **14.** 2395.3. **15.** 20.412. **16.** 10.88. **17.** 18.88. **18.** 8.88. **19.** 87.3. **20.** 2.876. **21.** 50.92 ft. **22.** 38.31 ft. **23.** 75.1 mi. **24.** 45.29 mi. **25.** 22.8 ft. **26.** 22.0 in. **27.** 24.6 in. **28.** 23.7 mi.

Page 123. **1.** 158.6. **2.** 2171.7 mi. **3.** 533.4 mi. **4.** 13.7 mi. **5.** 3.5 degrees. **6.** 334.0 mi. **7.** 5.55 in.

Page 124. **1.** 7.5. **2.** 19.3. **3.** 21.75. **4.** 62.28. **5.** 10.710. **6.** 15.0. **7.** 20.4. **8.** 39.5. **9.** 73.3. **10.** 59.37. **11.** 28.97. **12.** 40.70. **13.** 121.74. **14.** 12.019. **15.** 16.893. **16.** 132.44. **17.** 221.85. **18.** 118.51. **19.** 124.45. **20.** 155.54. **21.** 214.34. **22.** 116.39. **23.** 185.37. **24.** 23.158. **25.** 39.719.

Page 125. **1.** $\frac{1}{5}$; because it is larger. **2.** $\frac{3}{5}$. **3.** $\frac{3}{10}$. **4.** $\frac{33}{40}$. **5.** $8\frac{1}{4}$. **6.** $\frac{5}{8}$. **7.** $\frac{1}{8}$; $400. **8.** $\frac{1}{3}$; $2370.25. **9.** $\frac{2}{3}$. **10.** $\frac{2}{3}$. **11.** $1\frac{1}{3}$. **12.** $1\frac{1}{3}$. **13.** $1\frac{2}{3}$. **14.** $1\frac{2}{3}$. **15.** $2\frac{2}{3}$. **16.** $6\frac{2}{3}$. **17.** $3\frac{1}{3}$. **18.** $7\frac{1}{3}$.

Page 126. **1.** 1.75, 2.60. **2.** 0.50, 0.35. **3.** 0.20, 0.02. **4.** 0.500, 0.008. **5.** 0.800, 0.648. **6.** 0.8, 0.9. **7.** 0.70, 0.08. **8.** 0.120, 0.508. **9.** 0.350, 0.008. **10.** 0.89, 0.06. **11.** 16.05; 6.056; 4.224.

Page 127. **1.** 11.35. **2.** 0.75. **3.** 0.625. **4.** 0.8. **5.** 0.875. **6.** 0.063. **7.** 0.188. **8.** 0.813. **9.** 0.031. **10.** 0.156. **11.** 0.36. **12.** 0.833. **13.** 0.889.

Page 129. **1.** 40.30 ft. **2.** 37.66 in. **3.** 21.28 mi. **4.** 18.48 in. **5.** 78.75 ft. **6.** 6.72 oz. **7.** 5.84 ft. **8.** 18.85 yd. **9.** 56.56 ft. **10.** 8.52 in. **11.** 15.24 ft. **12.** 44.45 lb. **13.** 90.63. **14.** 191.52. **15.** 64.20. **16.** 303.24. **17.** 308.32. **18.** 362.88. **19.** 699.55. **20.** 305.44. **21.** 197.54. **22.** 641.16. **23.** 324.72. **24.** 153.76. **25.** 562.52. **26.** 6281.08. **27.** 5958.26. **28.** 3851.65. **29.** 665.10. **30.** 379.24. **31.** 1392.50. **32.** 1793.52. **33.** 710.80. **34.** 916.80. **35.** 3149.60. **36.** 5913.76. **37.** 31.0. **38.** 86.4. **39.** 171.0. **40.** 591.3. **41.** 205.8. **42.** 117.8. **43.** 124.7. **44.** 227.2. **45.** 239.33. **46.** 163.24. **47.** 102.85. **48.** 332.15. **49.** 199.35. **50.** 332.88. **51.** 236.61. **52.** 669.61. **53.** 49.657. **54.** 70.730. **55.** 32.819. **56.** 13.547. **57.** 14.706. **58.** 14.112. **59.** 13.248. **60.** 21.620.

Page 131. **1.** 313.5; 445.5; 554.4. **2.** $1215.45. **3.** $21.692. **4.** 42.1 ft. **5.** 57.5 lb. **6.** 73.1 lb. **7.** 5.03. **8.** 1.25. **9.** 5.9346. **10.** 59.346. **11.** 0.59346. **12.** 5934.60. **13.** 0.443. **14.** 0.193. **15.** 0.039750. **16.** 0.39750. **17.** 3.9750. **18.** 397.500. **19.** 7.28. **20.** 1.10. **21.** 12.9471. **22.** 129.471. **23.** 1.29471. **24.** 12947.10.

Page **132.** **25.** 1.96. **26.** 2.24. **27.** 8.25. **28.** 2.91. **29.** 6.96. **30.** 16.94. **31.** 2.34. **32.** 4.98. **33.** 57.84. **34.** 8.37. **35.** 2.43. **36.** 55.38. **37.** 66.6. **38.** 4.32. **39.** 654.5. **40.** 25.11. **41.** 46.4. **42.** 52.26. **43.** 57.6. **44.** 5.46. **45.** 120.6. **46.** 9.86. **47.** 44.4. **48.** 3.92. **49.** 49.0. **50.** 3.64. **51.** 24.0. **52.** 2.40. **53.** 30.618. **54.** 926.40. **55.** 19.062. **56.** 7217.52. **57.** 163.80.

Page **133.** **1.** 350. **2.** 420. **3.** 35. **4.** 42. **5.** 3.5. **6.** 14.2. **7.** 237. **8.** 23.7. **9.** 6250. **10.** 625. **11.** 12,500. **12.** 1250. **13.** 125. **14.** 612.5. **15.** 6125. **16.** 61,250. **17.** 375. **18.** 3750. **19.** 37,500. **20.** 15,000. **21.** 1500. **22.** 150. **23.** 272,500. **24.** 2725. **25.** 27.25. **26.** 275,000. **27.** 27,500. **28.** 2750. **29.** 275. **30.** 627,500. **31.** 62,750. **32.** 727,500. **33.** 8,275,000. **34.** 92,250. **35.** 20. **36.** 120. **37.** 125. **38.** 0.1. **39.** 1.1. **40.** 11.1.

Page **134.** **17.** 437.0. **18.** 275.6. **19.** 546.7. **20.** 2592. **21.** 1464. **22.** 3639.2. **23.** 43,548. **24.** 46,963. **25.** 30,800. **26.** 2250. **27.** 413,504. **28.** 7450. **29.** 487,780. **30.** 4,667,488. **31.** 5,015,920. **32.** 2,711,310. **33.** 2,286,315. **34.** 31,250.

Page **135.** **1.** 1.24. **2.** 0.83. **3.** 0.62. **4.** 0.53. **5.** 0.42. **6.** 0.35. **7.** 0.32. **8.** 2.8. **9.** 16.2. **10.** 0.29. **11.** 0.068. **12.** 0.680. **13.** 4.5$\frac{1}{3}$. **14.** 3.4. **15.** 0.272. **16.** 0.27$\frac{1}{5}$. **17.** 2.3. **18.** 0.23. **19.** 0.023. **20.** 0.0023. **21.** 220. **22.** 0.220. **23.** 2.20. **24.** 22.1. **25.** 223. **26.** 22.3. **27.** 2.23. **28.** 0.223. **29.** 0.0223. **30.** 0.2223. **31.** 82. **32.** 8.2. **33.** 8.21. **34.** 0.821. **35.** 0.0821. **36.** 0.3228$\frac{1}{4}$. **37.** 2.821. **38.** 28.21. **39.** 282.1. **40.** 2.507.

Page **136.** **1.** 1.7 in. **2.** 0.79 mi. **3.** 0.014 in. **4.** 27.2 in. **5.** 20.4 in. **6.** 16.3 in. **7.** 13.6 in. **8.** 0.85 mi. **9.** 0.091 in. **10.** 0.3848 in. **11.** 2.51 in. **12.** 25.1 in. **13.** 0.251 in. **14.** 21.3 in. **15.** 0.39 ft. **16.** 0.37 in. **17.** 0.026 mi. **18.** 2.57 mi. **19.** 0.257 mi. **20.** 25.7 mi. **21.** 0.004 in. **22.** 7.7 in. **23.** 2.54 in. **24.** $5.37. **25.** 4.2 mi. **26.** 31.8 ft. **27.** 1046.3. **28.** 343.5. **29.** 8.0. **30.** 10.3. **31.** 19.8. **32.** 14.0. **33.** 0.6. **34.** 1.3. **35.** 7.5. **36.** 1.70. **37.** 0.96. **38.** 0.54. **39.** 2.57. **40.** 2.04. **41.** 0.89. **42.** 0.88. **43.** 0.95. **44.** 0.52. **45.** 1.18. **46.** 2.67. **47.** 1.85. **48.** 2.06. **49.** 1.52. **50.** 1.22. **51.** 0.88. **52.** 0.74. **53.** 2.15. **54.** 0.07. **55.** 0.27. **56.** 0.16. **57.** 0.919. **58.** 1.359. **59.** 0.038.

Page **138.** **1.** 37.5; 3.75. **2.** 3.7; 0.37. **3.** 0.3; 0.03. **4.** 0.02; 0.002. **5.** 0.37; 0.037. **6.** 1.35; 0.135. **7.** 0.300. **8.** 0.030. **9.** 0.003. **10.** 0.025. **11.** 0.250. **12.** 0.275. **13.** 0.57. **14.** 1.18. **15.** 17.9. **16.** 0.63. **17.** 0.746. **18.** 2.812. **19.** 0.042. **20.** 0.024. **21.** 0.051.

Page **139.** **1.** 2. **2.** 20. **3.** 200. **4.** 200. **5.** 2000. **6.** 3.5. **7.** 35. **8.** 350. **9.** 35. **10.** 350. **11.** 2. **12.** 20. **13.** 20. **14.** 200. **15.** 200. **16.** 2000. **17.** 2000. **18.** 1500. **19.** 1200. **20.** 12,000. **21.** 2. **22.** 0.2. **23.** 0.2. **24.** 2. **25.** 200. **26.** 200. **27.** 20. **28.** 200. **29.** 2000. **30.** 20,000.

Page **141.** **1.** 32.1 min.; 41 min.; to the nearest 0.1 min. **2.** 41 min.; 52.2 min. **3.** 17 min. **4.** 0.2. **5.** 0.02 in. **6.** 0.1345. **7.** 0.02624. **8.** 1.268.

9. 0.01206. 10. 0.00606. 11. 0.0001338. 12. 11.853. 13. 270.565. 14. 14.271. 15. 6.213. 16. 5.792. 17. 99.034. 18. 4.916. 19. 1568.889. 20. 1.050. 21. 3 hr. 22. 0.7692.

Page 143. 1. 2.5. 2. 0.25. 3. 2.25. 4. 32.5. 5. 3.25. 6. 0.325. 7. 1.35. 8. 1.325. 9. 1.375. 10. 0.5. 11. 1.5. 12. 0.25. 13. 2.755. 14. 2.055. 15. 3.525. 16. 5¢. 17. 7¢. 18. $2\frac{1}{2}$¢. 19. $7\frac{1}{2}$¢. 20. $17\frac{1}{2}$¢. 21. $1\frac{1}{2}$¢. 22. $2\frac{1}{2}$¢. 23. $12\frac{1}{2}$¢. 24. 25¢. 25. \$3.75.

Page 145. 1. \$8.67; \$76. 2. \$26.67; \$18.67. 3. \$25. 4. \$165.33. 5. \$144. 6. \$14; \$28. 7. \$22; \$44. 8. \$26; \$52. 9. \$32; \$64. 10. \$180; \$360. 11. \$8; \$6. 12. \$16; \$12. 13. \$24; \$18. 14. \$32; \$24. 15. \$40; \$30.

Page 146. 18. \$6. 19. \$2. 20. \$4. 21. \$6. 22. \$8. 23. \$15. 24. \$24. 25. \$24. 26. \$37.50. 27. \$45. 28. \$62. 29. \$48. 30. \$65. 31. \$63. 32. \$5. 33. \$9. 34. \$33. 35. \$33. 36. \$66. 37. \$105. 38. \$46.87$\frac{1}{2}$. 39. $6\frac{1}{4}$¢. 40. $41\frac{2}{3}$¢. 41. $31\frac{1}{4}$¢. 42. $43\frac{3}{4}$¢. 43. $3\frac{1}{8}$¢. 44. $9\frac{3}{8}$¢.

Page 147. 15. 130. 16. 12. 17. $62\frac{1}{2}$. 18. $55\frac{1}{3}$.

Page 148. 1. 3168. 2. 129.2 mi. 3. 125.4 mi. 4. 2178.1 mi. 5. 24¢. 6. \$2.40. 7. \$24. 8. 45¢. 9. \$45. 10. $1\frac{1}{4}$¢. 11. 1¢. 12. 1.1¢. 13. \$12.50. 14. \$50. 15. 50¢. 16. \$5. 17. 35¢. 18. 0.35¢. 19. \$7.50. 20. 82¢. 21. 1562.5. 22. 12.5. 23. 4239.00. 24. 7545.33$\frac{1}{3}$. 25. 25. 26. 0.25. 27. 120. 28. 12. 29. 0.5. 30. 5.

Page 149. 1. \$10.20. 2. \$15.66. 3. \$23.95. 4. \$34.40.

Page 150. 1. \$16.05. 2. \$45.40. 3. \$20.10. 4. \$18.00. 5. \$23.25. 6. \$26.25. 7. \$25.25.

Page 151. 1. \$1.89. 2. 96¢. 3. \$2.12. 4. \$4.43. 5. \$2.84. 6. \$6.02. 7. \$4.09.

Page 152. 1. \$39.30. 2. \$27.60. 3. \$4.80. 4. \$3.60. 5. \$1.20. 6. \$1.80. 7. \$1.60. 8. \$1.00. 9. \$2.10. 10. \$4.50. 11. \$32. 12. \$3.50. 13. 1320. 14. \$8.60. 15. \$10.40; \$15.60. 16. \$37.00.

Page 153. 1. \$1310. 2. \$2755. 3. \$1184. 4. \$216. 5. \$120. 6. \$52; \$55; \$65. 7. \$21. 8. \$84. 9. \$120. 10. 600. 11. 128.9 mi. 12. 26.7 mi. 13. 34.6 mi. 14. 26.6 mi.; 32.7 mi. 15. 0.4. 16. Frank. 17. \$37.84. 18. 191. 19. \$8.26; \$2.36.

Page 156. 1. 1320; 2640. 2. 440; 880. 3. 30. 4. 45. 5. 198. 6. 18. 7. 63. 8. $148\frac{1}{2}$. 9. $19\frac{1}{2}$. 10. 45. 11. 33. 12. 3960. 13. 135. 14. 660 ft. 15. 9 mi. 3960 ft. 16. 3960. 17. 2 mi. 4224 ft. 18. 2 mi. 1320 ft. 19. 3 mi. 3432 ft. 20. 4 mi. 1848 ft. 21. 5 mi. 4488 ft. 22. 3801.6 ft. 23. Same.

Page 157. 1. 504. 2. $40\frac{1}{2}$ sq. ft. 3. $60\frac{1}{2}$ sq. yd.; $544\frac{1}{2}$ sq. ft. 4. 63. 5. 2. 6. 162. 7. 121. 8. 80. 9. 1600. 10. 400.

Page 158. 7. $\frac{1}{4}$. 8. $\frac{1}{4}$. 9. 24 sq. in.; multiplies it by 4. 10. $\frac{3}{4}$.

Page 159. 4. 200. 5. 50. 6. 250. 7. 325. 8. 475. 9. 1000. 10. 4000. 11. 5000. 12. 7000. 13. 11,000. 14. 200. 15. 4200. 16. 4400. 17. 7000. 18. 9000. 19. 500. 20. 4500. 21. 18,500. 22. 17,500. 23. 13,500. 24. 1. 25. 3. 26. 4. 27. $\frac{1}{4}$. 28. $2\frac{1}{4}$. 29. $3\frac{1}{4}$. 30. $\frac{3}{4}$. 31. $1\frac{3}{4}$. 32. $2\frac{3}{4}$. 33. 1. 34. $\frac{1}{2}$. 35. $\frac{3}{4}$. 36. 8. 37. 40. 38. 4. 39. 52. 40. 12. 41. 2. 42. $\frac{1}{2}$. 43. $2\frac{1}{2}$. 44. 4. 45. $4\frac{1}{2}$.

Page 160. 5. 5. 6. 17. 7. 4. 8. 60. 9. $8\frac{1}{2}$. 10. 8. 11. $8\frac{1}{2}$. 12. 2. 13. 38. 14. 43.

Page 161. 2. 4. 3. 1. 4. 15. 5. 16. 6. 56. 7. 2. 8. $4\frac{1}{2}$. 9. 6. 10. 60. 11. 80. 12. 1. 13. 2. 14. 14. 15. 38. 16. 1. 17. 8. 18. $\frac{1}{2}$. 19. 16.

Page 162. 1. 30. 2. 2. 3. 75. 4. 90. 5. 36. 6. 3. 7. 60. 8. 54. 9. 165. 10. 50; 30. 11. 30. 12. 100.

Page 163. 1. 36; 42; 60; 63. 2. 30; 45. 3. 24; 288. 4. 4¢. 5. 6¢. 6. 6 doz. dozen; 864, 72.

Page 164. 1. 64; 65. 2. 1 hr. 11 min. 3. 40 min. 4. 264 ft. 5. 80¢; $6.00. 6. 648. 7. First; $6. 8. 20 yd. by $13\frac{1}{3}$ yd. 9. 200; $66\frac{2}{3}$.

Page 166. 1. 68. 2. $30\frac{15}{19}$ bu. 3. 538.5 ft. 4. 12 mi. 5. $27.28; $5\frac{1}{2}$. 6. $6420. 7. 400.

Page 167. 1. $3496.86. 2. $3922.45. 3. $2993.59. 4. $3691.37. 5. $\frac{5}{12}$. 6. $1\frac{1}{3}$. 7. $1\frac{5}{8}$. 8. $\frac{1}{8}$. 9. $62\frac{1}{2}$. 10. $\frac{3}{8}$. 11. $3\frac{7}{8}$. 12. $6\frac{9}{16}$. 13. $\frac{11}{16}$. 14. $4\frac{3}{8}$. 15. $1\frac{3}{5}$. 16. $38\frac{1}{4}$ in. 17. $4\frac{1}{4}$ in. 18. $4\frac{3}{16}$ ft. 19. $3\frac{2}{5}$ yd. 20. 3.90. 21. 1.46. 22. 2.475. 23. 1.1. 24. 1.95. 25. 0.59. 26. 0.8636. 27. 1.52. 28. 1.48. 29. 0.03. 30. 75. 31. 3.888. 32. 388.8. 33. 38.88. 34. 19.2 ft. 35. 5.2 mi. 36. 31.2 in. 37. 84.0 ft. 38. 84.0 ft. 39. 0.84 ft. 40. 8.40 ft.

Page 170. 1. 5. 2. 32. 3. 15. 4. 48. 5. $\frac{1}{4}$. 6. 22. 7. 19. 8. $\frac{1}{5}$. 9. 2. 10. 0. 11. 79. 12. 11. 13. 78. 14. 160. 15. $3\frac{3}{4}$. 16. 3. 17. 15. 18. 11. 19. 7. 20. 8.

Page 171. 1. $14; $15.50; $17; $13. 2. $18.25; $19.75; $22.00. 3. $740\frac{1}{4}$; 250. 4. 10. 5. 1500 gal. 6. 210 da.; 345 da. 7. $48. 8. $38.25. 9. 156 lb. 10. 60¢.

Page 172. 1. $20. 2. $19.20. 3. 1600. 4. 157. 5. 46. 6. $3.10.

Page 173. 1. 50. 2. $74.63. 3. $42\frac{2}{5}$¢. 4. $26. 5. 100. 6. $23\frac{1}{3}$. 7. $48.

Page 174. I. 1. 66 in. 2. $2\frac{1}{12}$ ft. 3. 124 oz. 4. $5\frac{1}{2}$ pk. 5. $25\frac{1}{3}$. 6. $48\frac{3}{4}$ ft. 7. $26\frac{1}{4}$ ft. 8. $27\frac{1}{2}$ ft.

II. 1. 81 in. 2. 3 yd. 3. 2880 A. 4. $6\frac{7}{9}$ sq. yd. 5. $3\frac{2}{9}$ yd. 6. $42\frac{21}{32}$ yd. 7. 46 bu. 8. 31.

III. 1. $15\frac{1}{3}$ yd. 2. 4 sq. mi. 3. 290 qt. 4. 1296 sq. in. 5. $67\frac{1}{2}$ lb. 6. $73\frac{5}{8}$ lb. 7. 2. 8. $8\frac{3}{4}$ lb.

IV. 1. $20\frac{1}{2}$ yd. 2. 3840 sq. rd. 3. 4500 lb. 4. 5 sq. yd. 5. $7\frac{3}{8}$. 6. 42 ft. 7. $25\frac{5}{8}$ ft. 8. $5\frac{1}{4}$ ft.

V. 1. 159.3812. 2. 407. 3. 22.08. 4. 22.71. 5. $6. 6. $7. 7. $36. 8. $55.

VI. 1. 93.09375. 2. 130. 3. 72.00. 4. 9.480. 5. 21.1008. 6. 1.5. 7. 15. 8. 62.0.

Page 177. 1. 13; 17; 15; 16; 15; 16; 15; 17; 16; 14. 2. 14; 18; 13; 15; 13; 11; 12; 14; 13; 12. 3. 17; 19; 17; 19; 17; 13; 16; 20; 25; 16. 4. 13; 11; 10; 18; 7; 16; 18; 13; 9; 23. 5. 8; 18; 14; 14; 19; 15; 21; 16; 15; 19. 6. 14; 17; 17; 21; 18; 14; 14; 20; 13; 19. 7. 16; 19; 9; 20; 11; 18; 15; 20; 17; 11.

Page 178. 1. 730; 702; 1299; 1278; 1449; 1839. 2. 1727; 1729; 934; 1628; 1107; 1395. 3. 3337; 1389; 1861; 1968; 1678; 957. 4. 2271; 1341; 1597; 1415; 2182; 1723. 5. 1965; 1922; 2551; 2378; 2401; 2426.

Page 179. 1. $1.90. 2. $327.85. 3. $310.15. 4. 606,760. 5. $1502.20. 6. $258.95.

Page 180. 1. $21.72; $10.56; $19.13; $16.20; $51.07. 2. $22.48; $31.11; $26.72; $31.91; $132.42. 3. $32.24; $39.64; $35.34; $36.64; $290.82. 4. $29.41; $33.49; $34.57; $36.45; $169.80.

Page 182. 1. 122; 422; 211; 242; 111; 523. 2. 129; 115; 509; 624; 629; 706. 3. 694; 192; 571; 480; 691; 261. 4. 184; 229; 256; 487; 79; 171. 5. 44; 459; 275; 367; 535; 116. 6. 309; 463; 545; 177; 489; 134. 7. 911; 623; 642; 417; 721; 328. 8. 533; 136; 618; 793; 248; 358. 9. 434; 655; 529; 424; 236; 234.

Page 183. 1. $6.10; $8.20; $2.30; $3.22; $15.23. 2. $4.28; $7.19; $2.15; $3.37; $21.04. 3. $2.63; $2.91; $4.87; $2.88; $11.86. 4. $1.88; $3.66; $6.02; $6.87; $39.89. 5. $1.69; $1.75; $1.36; $2.39; $20.89. 6. $4.76; $2.85; $6.11; $0.90; $10.12. 7. $8.22; $1.88; $1.88; $5.65; $4.65. 8. $3.47; $0.12; $1.80; $8.33; $10.92. 9. $0.47; $3.68; $2.20; $2.52; $35.26.

Page 184. 1. 311.4 mi. 2. $27.47. 3. $85.66. 4. 111,000. 5. 848,844. 6. $122.88. 7. 101,781,406. 8. 332,665,096 A.

Page 186. 1. 44; 54; 99; 114; 141; 164; 184; 268. 2. 155; 195; 240; 276; 342; 105; 190; 235. 3. 300; 336; 567; 623; 679; 728; 512; 784. 4. 180; 189; 234; 432; 486; 783; 657; 864. 5. 480; 544; 536; 472; 528; 584; 656; 776. 6. 480; 528; 474; 498; 574; 378; 672; 651. 7. 240; 400; 630; 210; 200; 240; 684; 266. 8. 301; 408; 639; 245; 240; 294; 603; 384. 9. 324; 456; 675; 273; 290; 204; 522; 522.

Page 187. **1.** \$25.02; \$19.62; \$28.38; \$9.80; \$224.38. **2.** \$37.17; \$22.92; \$47.18; \$141.00; \$290.85. **3.** \$72.18; \$23.00; \$46.45; \$259.49; \$463.87. **4.** \$37.15; \$32.10; \$27.18; \$447.39; \$1769.16. **5.** \$25.52; \$42.42; \$36.00; \$238.14; \$3460.08. **6.** \$23.44; \$61.74; \$21.96; \$192.00; \$4069.66. **7.** \$15.90; \$73.92; \$64.64; \$260.45; \$5504.82. **8.** \$48.00; \$72.63; \$37.56; \$197.46; \$8792.31. **9.** \$63.00; \$66.15; \$68.80; \$239.00; \$2515.20. **10.** \$47.81; \$38.94; \$36.54; \$359.55; \$6552.72.

Page 188. **1.** \$85.00; \$188.24. **2.** \$273.24. **3.** \$20.40. **4.** \$18.33. **5.** \$402.48. **6.** \$212.75. **7.** \$185.22. **8.** \$104.40. **9.** \$11.16. **10.** \$86.48.

Page 190. **10.** 9. **11.** 4. **12.** 8. **13.** 7. **14.** 8. **15.** 6. **16.** 3. **17.** 5. **18.** 5. **19.** 9. **20.** 8. **21.** 4. **22.** 7. **23.** 6. **24.** 6. **25.** 7. **26.** 6. **27.** 9. **28.** 3. **29.** 9. **30.** 12. **31.** 10. **32.** 12. **33.** 12. **34.** 11. **35.** 11. **36.** 9. **37.** 12. **38.** 4. **39.** 3.

Page 192. **1.** $701\frac{3}{7}$. **2.** 604. **3.** $1400\frac{2}{5}$. **4.** $600\frac{7}{8}$. **5.** $900\frac{2}{9}$. **6.** $1300\frac{1}{3}$. **7.** $2400\frac{1}{2}$. **8.** 2040. **9.** $1200\frac{3}{4}$. **10.** $1502\frac{1}{5}$. **11.** 1106. **12.** 802. **13.** 606. **14.** 902. **15.** 1206. **16.** 804. **17.** $910\frac{1}{5}$. **18.** $901\frac{1}{6}$. **19.** $801\frac{2}{7}$. **20.** $802\frac{1}{8}$. **21.** 11. **22.** 110. **23.** 110. **24.** 111. **25.** 111. **26.** 111. **27.** 110. **28.** 111. **29.** 210. **30.** 211. **31.** 212. **32.** 300. **33.** 303. **34.** 120. **35.** 121. **36.** 152. **37.** 210. **38.** 211. **39.** 110. **40.** 111. **41.** 144. **42.** 154. **43.** 155. **44.** 81. **45.** 71. **46.** 61. **47.** 70. **48.** 71. **49.** 81. **50.** 51. **51.** 28.

Page 193. **1.** 10.5. **2.** 26.3. **3.** \$4223. **4.** \$582. **5.** 68¢. **6.** 16. **7.** \$96.08. **8.** 38,750; 106. **9.** \$112.93.

Page 194. **1.** \$7.20. **2.** \$16. **3.** \$6.90.

Page 195. **1.** \$1.80. **2.** \$3.20. **3.** \$1.60. **4.** \$2.40. **5.** \$8.25; \$4.40.

Page 196. **1.** \$82.25. **2.** \$20.90. **3.** \$29.50. **4.** \$135.75. **5.** \$38.49.

Page 197. **1.** \$263.95. **2.** \$1686.00. **3.** \$5173.75. **4.** \$2671.25. **5.** \$4265.25.

Page 198. **7.** Four hundred forty-one million five hundred ninety-five thousand nine hundred sixty-five. **8.** One billion nine hundred eight million six hundred thirty-five thousand dollars; twenty-six billion five hundred ninety-six million seven hundred one thousand six hundred forty-eight dollars.

Page 199. **13.** 1. **14.** $\frac{1}{2}$. **15.** $\frac{3}{16}$. **16.** $\frac{3}{16}$. **17.** 3. **18.** $\frac{1}{2}$.

Page 200. **21.** $\frac{9}{12}$. **22.** $\frac{8}{12}$. **23.** $\frac{10}{16}$. **24.** $\frac{10}{12}$. **25.** $\frac{8}{16}$. **26.** $\frac{12}{20}$. **27.** $\frac{7}{8}$. **28.** $1\frac{3}{8}$. **29.** $\frac{5}{6}$. **30.** $1\frac{1}{12}$. **31.** $1\frac{7}{12}$. **32.** $1\frac{11}{12}$. **33.** $\frac{13}{15}$. **34.** $1\frac{2}{5}$. **35.** $\frac{47}{60}$. **36.** Same. **37.** $4\frac{1}{4}$. **38.** $6\frac{1}{2}$. **39.** $5\frac{7}{8}$. **40.** $6\frac{1}{8}$. **41.** $5\frac{5}{6}$. **42.** $6\frac{1}{8}$. **43.** $7\frac{7}{12}$. **44.** $8\frac{5}{12}$. **45.** $7\frac{1}{3}$. **46.** $8\frac{1}{12}$. **47.** $9\frac{7}{12}$. **48.** $3\frac{7}{24}$.

Page 201. **21.** $\frac{6}{8}$. **22.** $\frac{12}{16}$. **23.** $\frac{20}{24}$. **24.** $\frac{6}{16}$. **25.** $\frac{1}{8}$. **26.** $\frac{3}{8}$. **27.** $\frac{1}{8}$. **28.** $\frac{3}{8}$. **29.** $\frac{5}{8}$. **30.** $\frac{1}{3}$. **31.** $\frac{1}{3}$. **32.** $\frac{1}{12}$. **33.** $\frac{7}{12}$. **34.** $\frac{1}{12}$. **35.** $\frac{1}{12}$. **36.** $\frac{7}{16}$. **37.** $\frac{3}{16}$. **38.** $\frac{1}{16}$. **39.** $\frac{5}{16}$. **40.** $7\frac{3}{8}$. **41.** 4. **42.** $4\frac{3}{8}$. **43.** $7\frac{7}{8}$. **44.** $1\frac{11}{16}$. **45.** $6\frac{1}{3}$. **46.** $5\frac{9}{16}$.

Page 202. **8.** $27\frac{1}{2}$ lb. **9.** $2\frac{1}{8}$ in. **10.** $\frac{1}{2}$ yd. **11.** $38\frac{3}{4}$. **12.** $\frac{5}{12}$ ft. **13.** $23\frac{1}{4}$ ft. **14.** $4\frac{29}{30}$ min. **15.** 1, $1\frac{1}{8}$, $1\frac{1}{6}$, $1\frac{3}{16}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $1\frac{1}{16}$, $\frac{13}{16}$, $\frac{7}{8}$.

Page 203. **22.** $\frac{1}{3}$. **23.** $\frac{1}{4}$. **24.** $\frac{1}{2}$. **25.** $\frac{2}{5}$. **26.** $\frac{1}{8}$. **27.** $\frac{1}{4}$. **28.** $\frac{1}{16}$. **29.** $\frac{5}{16}$. **30.** $\frac{7}{10}$. **31.** $\frac{1}{16}$. **32.** $\frac{1}{8}$. **33.** $\frac{1}{32}$. **34.** $\frac{1}{8}$. **35.** $\frac{1}{4}$. **36.** $\frac{1}{24}$. **37.** $\frac{5}{24}$. **38.** $\frac{1}{2}$. **39.** $\frac{1}{8}$. **40.** $9\frac{1}{6}$; $9\frac{1}{3}$. **41.** $2\frac{1}{4}$. **42.** $3\frac{3}{8}$. **43.** $6\frac{7}{8}$. **44.** $6\frac{29}{32}$. **45.** $7\frac{31}{32}$. **46.** $6\frac{1}{2}$. **47.** 7. **48.** $25\frac{2}{3}$. **49.** $26\frac{17}{64}$. **50.** $27\frac{35}{64}$. **51.** $2\frac{8}{9}$. **52.** $3\frac{11}{18}$. **53.** $4\frac{13}{18}$. **54.** $1\frac{1}{2}$. **55.** $3\frac{23}{24}$.

Page 204. **1.** $\frac{1}{3}$. **2.** $\frac{3}{8}$ lb. **3.** $27\frac{5}{8}$ mi. **4.** 30¢. **5.** $12\frac{1}{4}$. **6.** $46\frac{1}{4}$ ft. **7.** $140\frac{7}{8}$ mi. **8.** 138 lb. **9.** $6.80. **10.** 102 qt. **11.** $13\frac{7}{8}$ gal. **12.** $27\frac{9}{16}$ gal. **13.** $1\frac{1}{4}$ gal.

Page 205. **21.** 7; $\frac{1}{7}$. **22.** 2. **23.** $\frac{1}{2}$. **24.** $\frac{2}{3}$. **25.** $1\frac{1}{2}$. **26.** 2. **27.** $\frac{1}{2}$. **28.** $1\frac{1}{2}$. **29.** $\frac{1}{2}$. **30.** 2. **31.** $\frac{6}{7}$. **32.** $1\frac{1}{6}$. **33.** $\frac{5}{6}$. **34.** $\frac{2}{5}$. **35.** $\frac{2}{3}$. **36.** $1\frac{1}{2}$. **37.** $\frac{3}{4}$. **38.** $1\frac{1}{3}$. **39.** $1\frac{1}{3}$. **40.** $\frac{1}{5}$. **41.** $\frac{16}{21}$. **42.** Same. **43.** 2. **44.** 2. **45.** $\frac{1}{3}$. **46.** $1\frac{9}{13}$. **47.** $1\frac{3}{22}$. **48.** $\frac{22}{31}$. **49.** $3\frac{4}{7}$. **50.** $8\frac{5}{8}$. **51.** $5\frac{13}{16}$. **52.** $\frac{1}{4}$. **53.** $\frac{7}{22}$. **54.** $\frac{15}{22}$. **55.** $29\frac{1}{3}$. **56.** $4\frac{4}{21}$. **57.** $1\frac{19}{69}$. **58.** 3. **59.** $2\frac{5}{6}$. **60.** $2\frac{14}{45}$.

Page 206. **1.** 59. **2.** 25. **3.** 21. **4.** 13. **5.** 5 hr. **6.** $106\frac{1}{7}$. **7.** 11. **8.** 7. **9.** 7. **10.** 41. **11.** 10.

Page 207. **1.** $\frac{1}{10}$; less. **2.** $\frac{2}{3}$. **3.** $\frac{1}{3}$. **4.** $\frac{1}{4}$; $\frac{3}{4}$. **5.** $\frac{1}{2}$. **6.** $\frac{1}{3}$. **7.** $\frac{2}{3}$. **8.** $\frac{3}{4}$. **9.** $\frac{6}{7}$. **10.** $\frac{5}{7}$. **11.** $\frac{1}{3}$. **12.** $\frac{2}{3}$.

Page 208. **1.** $2; $6; 2¢. **2.** 12. **3.** 2; 16. **4.** 4. **5.** 8. **6.** 16. **7.** 6. **8.** 9. **9.** 12. **10.** 32. **11.** 24. **12.** 33. **13.** 40. **14.** 75. **15.** 72. **16.** 70. **17.** 200. **18.** 18. **19.** 16. **20.** 15. **21.** 40. **22.** 24. **23.** 16. **24.** 40. **25.** 128. **26.** 48. **27.** 32. **28.** 48. **29.** 80. **30.** 48. **31.** 64.

Page 210. **1.** 6 cups, flour; $4\frac{1}{2}$ tablespoonfuls, shortening; $2\frac{1}{4}$ cups, milk; 12 teaspoonfuls, baking powder; $1\frac{1}{2}$ teaspoonfuls, salt. **2.** 5 cups, molasses; $2\frac{1}{2}$ cups, boiling water; $12\frac{1}{2}$ cups, flour; 5 teaspoonfuls, soda; $7\frac{1}{2}$ teaspoonfuls, ginger; 20 tablespoonfuls, butter. **3.** 6 cups, flour; $1\frac{1}{8}$ cups, lard; $1\frac{1}{2}$ teaspoonfuls, baking powder; 3 teaspoonfuls, salt; $\frac{3}{4}$ cup, cold water. **4.** $\frac{1}{6}$ teaspoonful, salt; $\frac{1}{3}$ cup, rice; 4 tablespoonfuls, sugar; $2\frac{2}{3}$ cups, milk; a little nutmeg for seasoning. **5.** $\frac{3}{8}$; $2\frac{2}{3}$; $4\frac{2}{3}$; $7\frac{1}{3}$. **6.** 3; $1\frac{1}{2}$. **7.** 48; $\frac{1}{48}$; $1\frac{1}{2}$.

Page 211. **1.** $3.50. **2.** 25¢; $3.25. **3.** James: 42, $3.36, 24¢, $3.12. Tom: 63, $5.04, 36¢, $4.68. William: $73\frac{1}{2}$, $5.88, 42¢, $5.46. Totals: 123, $215\frac{1}{4}$, $17.22, $1.23, $15.99. **4.** $1.28. **5.** $7.12.

Page 214. **1.** Five tenths. **2.** 0.4; $\frac{4}{10}$. **3.** Two hundred seventy-five thousandths; $\frac{11}{40}$. **4.** 0.08; $\frac{8}{100}$. **5.** Three, and three and one third tenths; $3\dfrac{3\frac{1}{3}}{10}$; $3\frac{1}{3}$. **6.** One and three thousand seven hundred fifty ten-thousandths; $1\frac{3750}{10000}$; $1\frac{3}{8}$. **7.** One hundred twenty-five millionths; $\frac{125}{1000000}$; $\frac{1}{8000}$. **8.** 0.000018; $\frac{18}{1000000}$; $\frac{9}{500000}$. **9.** 0.375; three hundred seventy-five thousandths; $\frac{3}{8}$. **10.** Fourteen and fourteen thousandths; $14\frac{7}{500}$. **11.** Two tenths; $\frac{2}{10}$; $\frac{1}{5}$. **12.** Six tenths; $\frac{6}{10}$; $\frac{3}{5}$. **13.** Eight tenths; $\frac{8}{10}$; $\frac{4}{5}$. **14.** Fifteen

hundredths; $\frac{15}{100}$; $\frac{3}{20}$. **15.** Twenty-five hundredths; $\frac{25}{100}$; $\frac{1}{4}$. **16.** Thirty-five hundredths; $\frac{35}{100}$; $\frac{7}{20}$. **17.** Forty-five hundredths; $\frac{45}{100}$; $\frac{9}{20}$. **18.** Seventy-five hundredths; $\frac{75}{100}$; $\frac{3}{4}$. **19.** Four tenths; $\frac{4}{10}$; $\frac{2}{5}$. **20.** Forty hundredths; $\frac{40}{100}$; $\frac{2}{5}$. **21.** Four hundred thousandths; $\frac{400}{1000}$; $\frac{2}{5}$. **22.** Four hundred forty thousandths; $\frac{440}{1000}$; $\frac{11}{25}$. **23.** Four hundred forty-four thousandths; $\frac{444}{1000}$; $\frac{111}{250}$. **24.** Five hundred thousandths; $\frac{500}{1000}$; $\frac{1}{2}$. **25.** Five hundred fifty thousandths; $\frac{550}{1000}$; $\frac{11}{20}$. **26.** Five hundred fifty-five thousandths; $\frac{555}{1000}$; $\frac{111}{200}$. **27.** Twelve and five tenths; $12\frac{5}{10}$; $12\frac{1}{2}$. **28.** One and twenty-five hundredths; $1\frac{25}{100}$; $1\frac{1}{4}$. **29.** Seventeen and five tenths; $17\frac{5}{10}$; $17\frac{1}{2}$. **30.** One and seventy-five hundredths; $1\frac{75}{100}$; $1\frac{3}{4}$. **31.** One and fifty-five hundredths; $1\frac{55}{100}$; $1\frac{11}{20}$. **32.** Fifteen and five tenths; $15\frac{5}{10}$; $15\frac{1}{2}$. **33.** One, and sixteen and two thirds hundredths; $1\,\frac{16\frac{2}{3}}{100}$; $1\frac{1}{6}$. **34.** Eleven, and six and two thirds tenths; $11\,\frac{6\frac{2}{3}}{10}$; $11\frac{2}{3}$. **35.** Three and one third tenths; $\frac{3\frac{1}{3}}{10}$; $\frac{1}{3}$. **36.** Thirty-three and one third hundredths; $\frac{33\frac{1}{3}}{100}$; $\frac{1}{3}$. **37.** Six and two thirds tenths; $\frac{6\frac{2}{3}}{10}$; $\frac{2}{3}$. **38.** Sixty-six and two thirds hundredths; $\frac{66\frac{2}{3}}{100}$; $\frac{2}{3}$. **39.** Five, and twelve and one half hundredths; $5\,\frac{12\frac{1}{2}}{100}$; $5\frac{1}{8}$. **40.** Fifty-one, and two and one half tenths; $51\,\frac{2\frac{1}{2}}{10}$; $51\frac{1}{4}$. **41.** Fifty-one and twenty-five hundredths; $51\frac{25}{100}$; $51\frac{1}{4}$. **42.** Five and one hundred twenty-five thousandths; $5\frac{125}{1000}$; $5\frac{1}{8}$.

Page 215. **1.** 15.68. **2.** 19.663. **3.** 27.0649. **4.** 1.22162. **5.** 8.712432. **6.** 50.035. **7.** 49.492. **8.** 16.5009. **9.** 119.0064. **10.** 331.93678. **11.** 11.079029. **12.** 9.1101. **13.** 131.3351. **14.** 26.481. **15.** 38.9892. **16.** 17.93863. **17.** 29.845157. **18.** 193.2 ft. **19.** The measurements should be given to the same number of decimal places; 107.9 ft.; 210.70 ft.; 637.2 ft.

Page 217. **1.** 3.2347. **2.** 2.1269. **3.** 3.7329. **4.** 0.4238. **5.** 4.86858. **6.** 0.05868. **7.** 3.41395. **8.** 0.60347. **9.** 1.85451. **10.** 2.13095. **11.** 4.91720. **12.** 6.4998. **13.** 292.7839. **14.** 89.4596. **15.** 112.6739. **16.** 211.1291. **17.** 1.3. **18.** 1.4. **19.** 46.2. **20.** 5.73. **21.** 0.01. **22.** 26.27. **23.** 5.103. **24.** 53.533. **25.** 1.3807. **26.** 1.2214. **27.** 6.71. **28.** 0.7724. **29.** 1.091. **30.** 1.664. **31.** 0.882.

Page 218. **1.** $\frac{7}{8}$. **2.** $\frac{3}{8}$. **3.** $\frac{5}{8}$. **4.** $1\frac{7}{8}$. **5.** $1\frac{7}{10}$. **6.** $2\frac{3}{5}$. **7.** $3\frac{1}{2}$. **8.** $7\frac{9}{10}$. **9.** $\frac{9}{160}$. **10.** $\frac{1}{800}$. **11.** $\frac{3}{4}$. **12.** $\frac{1}{8}$. **13.** $\frac{5}{8}$. **14.** $\frac{7}{8}$. **15.** $\frac{1}{3}$.

Page 219. **1.** 16.1. **2.** 1.61. **3.** 0.161. **4.** 0.161. **5.** 141.6. **6.** 14.16. **7.** 1.416. **8.** 1.416. **9.** 745.2. **10.** 74.52. **11.** 7.452. **12.** 7.452. **13.** 76.942. **14.** 7.6942. **15.** 76.942. **16.** 76.942. **17.** 414,824.3. **18.** 41.48243. **19.** 41.48243. **20.** 4.148243.

Page 220. **1.** 37.6 mi.; 56.4 mi.; 75.2 mi. **2.** 57.8 mi.; 86.7 mi.; 115.6 mi.; 346.8 mi. **3.** 649.6 mi.; 742.4 mi.; 835.2 mi. **4.** \$3.58. **5.** 1820.2 T. **6.** Kate. **7.** Mary. **8.** Helen.

Page 221. **16.** 864. **17.** 86.4. **18.** 86.4. **19.** 8.64. **20.** 0.864. **21.** 0.864. **22.** 0.900. **23.** 9.00. **24.** 45.00. **25.** 45.00. **26.** 53.72. **27.** 5.372. **28.** 5.372. **29.** 9300. **30.** 930.0. **31.** 930.0. **32.** 93.00. **33.** 9.300. **34.** 93.00. **35.** 106.25. **36.** 106.25. **37.** 1062.5. **38.** 10.625. **39.** 31.92. **40.** 31.92. **41.** 2.295. **42.** 18,000. **43.** 1800.0. **44.** 180.00. **45.** 1800.0. **46.** 180.00. **47.** 180.00. **48.** 1.8000. **49.** 18.000. **50.** 1.8000. **51.** 0.18000. **52.** 53.3600. **53.** 53,360.0. **54.** 53.3600.

Page 223. **21.** 25. **22.** 250. **23.** 2.5. **24.** 2.5. **25.** 25. **26.** 12. **27.** 1.2. **28.** 0.12. **29.** 1.2. **30.** 12. **31.** 125. **32.** 12,500. **33.** 125. **34.** 1.25. **35.** 12,500. **36.** 234. **37.** 0.0234. **38.** 0.234. **39.** 23.4. **40.** 2.34. **41.** 341. **42.** 0.0341. **43.** 0.341. **44.** 0.341. **45.** 341. **46.** 573. **47.** 57,300. **48.** 573. **49.** 5.73. **50.** 5.73.

Page 225. **1.** 2.4. **2.** 1.08. **3.** 0.108. **4.** 1.14. **5.** 0.146. **6.** 20.1. **7.** 1.31. **8.** 0.021. **9.** 17.2. **10.** 1842. **11.** 16.6. **12.** 37.2. **13.** 140. **14.** 228.1. **15.** 8.6. **16.** 0.512. **17.** 0.051. **18.** 5.122. **19.** 0.412. **20.** 17.872. **21.** 0.928. **22.** 58.463. **23.** 11.630. **24.** 11.200. **25.** 1.021. **26.** 67.447. **27.** 0.041. **28.** 0.55. **29.** 22.02. **30.** 23.03. **31.** 0.03. **32.** 0.65. **33.** 0.67. **34.** 3.42. **35.** 6.21. **36.** 4.21. **37.** 1.86. **38.** 7.00. **39.** 22.80.

Page 226. **1.** 59.8. **2.** 10.58. **3.** 1.426. **4.** 0.01380. **5.** 0.01334. **6.** 0.71610. **7.** 25,461. **8.** 267.03. **9.** 0.27945. **10.** 33,489. **11.** 345.87. **12.** 3.5136. **13.** 0.24816. **14.** 0.4425. **15.** 0.03225. **16.** 32.4356.

Page 228. **1.** \$75. **2.** 9. **3.** 32.5 ft. **4.** 9. **5.** \$90. **6.** \$30; \$37; \$66.25. **7.** \$9.30. **8.** 200. **9.** 656,000 T. **10.** \$100. **11.** \$100. **12.** 225. **13.** \$9375.

Page 230. **1.** 96¢. **2.** \$1.44. **3.** \$1.47. **4.** \$1.45. **5.** \$6.16; \$7.04. **6.** \$320; \$576. **7.** \$2.24. **8.** \$178.50. **9.** \$76.50; \$189. **10.** \$19.04. **11.** \$24.64. **12.** \$2.72. **13.** \$16.25; \$26; \$243.75. **14.** \$5.94; \$14.52.

Page 231. **1.** 611.6 mi.; \$22.02. **2.** 40.5 mi.; 146.7 mi.; 350.4 mi.; 453.6 mi. **3.** 66¢; \$5.94; \$16.99. **4.** \$5.80; \$9.51; \$14.54. **5.** 10 hr. 45 min.; 4 hr. 25 min.

Page 233. **1.** 250. **2.** 4120. **3.** 192.5 min.; 30; 6.4 min. **4.** 17.3 mi. **5.** 7. **6.** \$3,000,000. **7.** 2960 lb.; \$12. **8.** \$19.80.

Page 236. **1.** \$168. **2.** \$405. **3.** \$148.50; \$174.38. **4.** \$37.80; \$39.90; \$47.04. **5.** \$180.98; \$185.74; \$218.12. **6.** \$436.14; \$466.79; \$575.23. **7.** \$557.81; \$592.88; \$749.06. **8.** \$1109.90; \$1061.38; \$1243.33.

Page 238. **1.** \$44.10. **2.** \$88.20. **3.** \$53.63; \$21.94. **4.** \$28.13. **5.** \$2520. **6.** \$56.10. **7.** \$16.50. **8.** \$21. **9.** \$51.24; \$76.25; \$152.50. **10.** \$17.25. **11.** \$3.25; 39¢.

Page 239. **1.** MDCCCCXXVIII, or MCMXXVIII; MDCCCCXXXV, or MCMXXXV; 79; 188. **2.** 8708; 4354; 14,217,987; 3. **3.** 21,987; 15,705; 59,195,286; 6. **4.** 33,768; 25,326; 124,717,887; 7. **5.** 36,234; 24,156; 182,347,605; 5. **6.** 63,090; 49,070; 393,120,800; 8. **7.** 35,505; 21,303; 201,696,804; 4. **8.** 34,560; 27,648; 107,495,424; 9. **9.** 28,301; 20,215; 98,075,094; 6. **10.** 77,770; 62,216; 544,335,561; 9. **11.** $1\frac{5}{12}$; $\frac{1}{12}$; $\frac{1}{2}$; $1\frac{1}{8}$; $\frac{8}{9}$. **12.** $\frac{17}{24}$; $\frac{1}{24}$; $\frac{1}{8}$; $1\frac{1}{8}$; $\frac{8}{9}$. **13.** $1\frac{7}{24}$; $\frac{1}{24}$; $\frac{5}{12}$; $1\frac{1}{15}$; $\frac{15}{16}$. **14.** $\frac{19}{24}$; $\frac{13}{24}$; $\frac{1}{12}$; $5\frac{1}{3}$; $\frac{3}{16}$. **15.** $\frac{7}{8}$; $\frac{5}{8}$; $\frac{8}{32}$; 6; $\frac{1}{6}$. **16.** $1\frac{3}{8}$; $\frac{1}{8}$; $\frac{15}{32}$; $1\frac{1}{5}$; $\frac{5}{6}$. **17.** $\frac{11}{16}$; $\frac{5}{16}$; $\frac{3}{32}$; $2\frac{2}{3}$; $\frac{3}{8}$. **18.** $\frac{7}{16}$; $\frac{3}{16}$; $\frac{5}{128}$; $2\frac{1}{2}$; $\frac{2}{5}$. **19.** $\frac{11}{16}$; $\frac{1}{16}$; $\frac{15}{128}$; $1\frac{1}{5}$; $\frac{5}{6}$. **20.** $\frac{13}{16}$; $\frac{7}{16}$; $\frac{15}{128}$; $3\frac{1}{3}$; $\frac{3}{10}$. **21.** $6\frac{3}{8}$. **22.** $12\frac{1}{2}$. **23.** $13\frac{1}{8}$. **24.** $30\frac{3}{16}$. **25.** $22\frac{13}{16}$. **26.** $6\frac{2}{3}$. **27.** $13\frac{1}{3}$. **28.** 2. **29.** 102.0. **30.** 10.20. **31.** 3. **32.** 3. **33.** 18.5. **34.** 3200. **35.** 570. **36.** 4.0380. **37.** 157.779. **38.** 215.6759. **39.** 664.7612. **40.** 18. **41.** 50. **42.** 8. **43.** 7.68. **44.** 24.99.

Page 242. **1.** 103.2 mi.; 129.0 mi.; 141.9 mi.; 172.0 mi. **2.** 247.2 mi.; 267.8 mi.; 309.0 mi.; 391.4 mi. **3.** 117.8 mi.; 130.2 mi.; 86.8 mi.; 53.7 mi. **4.** \$18; \$19.80; \$28.20; \$3.20; \$6.40. **5.** 2 hr. 45.9 min. **6.** 93.0 mi. **7.** \$17.60; \$18.40; \$21.20. **8.** 8.5. **9.** \$4.19. **10.** 1093.8 lb. **11.** 35 min.

Page 243. **1.** \$41.60. **2.** \$25.25. **3.** \$14.40. **4.** \$11.90. **5.** 28¢. **6.** 32¢. **7.** 5¢.

Page 244. I. **1.** $\frac{75}{2}$. **2.** $4\frac{19}{24}$. **3.** $1518\frac{5}{8}$. **4.** \$6255. **5.** \$123.36. **6.** 615. **7.** $2\frac{1}{2}$. **8.** \$6.75.

II. **1.** 349.328. **2.** 5.149. **3.** 2012. **4.** \$41.41. **5.** 87.035 ft. **6.** \$3988. **7.** \$121.50. **8.** \$4078.80.

III. **1.** 142.94000. **2.** 0.064. **3.** \$13.10. **4.** 9.851. **5.** 71.09. **6.** 0.15 ft. **7.** 103 yd. **8.** \$68.40. **9.** \$210. **10.** \$2200.

IV. **1.** $\frac{47}{8}$. **2.** $\frac{14}{4}$. **3.** 6.23. **4.** 48. **5.** 1752.8832. **6.** 4. **7.** 241,600. **8.** 8210. **9.** 246.3000. **10.** 1100.0.

V. **1.** \$437. **2.** \$986. **3.** 12.083. **4.** $35\frac{1}{2}$. **5.** 5928.000.

Page 247. **1.** \$21.65. **2.** \$27.30. **3.** \$5.18. **4.** \$4.90. **5.** \$30.10. **6.** \$4.58. **7.** \$1.18. **8.** \$33.75. **9.** \$5.66. **10.** \$10.21. **11.** \$85.00. **12.** \$40.65.

Page 252. **1.** $1\frac{2}{3}$ yd. **2.** 59; $1\frac{23}{36}$. **3.** $18\frac{2}{11}$. **4.** 5280; 15,840; 190,080. **5.** 6 ft. **6.** 2 yd. **7.** 864 in. **8.** 216 ft. **9.** 396 yd. **10.** 1188 ft. **11.** 27 in. **12.** $2\frac{1}{4}$ ft. **13.** 260 in. **14.** $21\frac{2}{3}$ ft. **15.** 3 rd. **16.** $49\frac{1}{2}$ ft. **17.** 284 in.; 23 ft. 8 in. **18.** 41 ft.; $13\frac{2}{3}$ yd.; 13 yd. 2 ft. **19.** $2174\frac{1}{2}$ yd.; $395\frac{4}{11}$ rd. **20.** $13{,}208\frac{1}{4}$ ft.; $800\frac{1}{2}$ rd. **21.** $4\frac{31}{36}$ yd.; 4 yd. $2\frac{7}{12}$ ft.

Page 253. **6.** 504 sq. in. **7.** 12 sq. ft.; $1\frac{1}{3}$ sq. yd. **8.** 20 cu. yd.; 14,580 cu. ft.

Page 254. **3.** $\frac{1}{2}$ lb.; $\frac{1}{4}$ lb.; $\frac{1}{8}$ lb.; $\frac{5}{8}$ lb.; $\frac{3}{4}$ lb. **4.** 8; 26. **5.** 2 lb. **6.** 512 oz. **7.** 64,000 lb. **8.** 5500 lb. **9.** 44 oz. **10.** $\frac{11}{64}$ lb. **11.** 0.17 lb. **12.** $8\frac{3}{4}$ T.; 175 cwt. **13.** $182\frac{1}{2}$ T.; 730,000 lb.

Page 255. **1.** $2\frac{1}{2}$. **2.** 10. **3.** 30 pt. **4.** $8\frac{1}{2}$ qt. **5.** 14 qt. **6.** 111 pt. **7.** 6; 48. **8.** $9\frac{1}{2}$ qt. **9.** $1\frac{3}{16}$ pk. **10.** 6 pk. **11.** 132 qt. **12.** 93 qt.; $11\frac{5}{8}$ pk.; 186 pt. **13.** 23 pt.; $11\frac{1}{2}$ qt.

Page 256. **3.** 150 min. **4.** 150 sec. **5.** $17\frac{1}{2}$ da. **6.** 30 mo. **7.** 25 dimes. **8.** 250¢. **9.** 37 dimes. **10.** $4.80. **11.** 365; 366. **12.** $9\frac{5}{8}$ da.; 231 hr.

Page 257. **1.** 9′. **2.** 32,400″. **3.** 9°. **4.** $4\frac{3}{4}$°. **5.** 130′. **6.** 130″. **7.** 10,983″. **8.** 18,620″.

Page 258. **1.** $8. **2.** $4. **3.** 355. **4.** 120; 300. **5.** 116 ft. **6.** 14,580. **7.** $67\frac{1}{2}$. **8.** $67\frac{1}{2}$. **9.** 108; 6480.

Page 259. **1.** 63 ft. 11 in. **2.** 132 ft. 2 in. **3.** 142 sq. ft. 33 sq. in. **4.** 175 sq. ft. 122 sq. in. **5.** 71 yd. 17 in. **6.** 138 yd. 18 in. **7.** 829 lb. 10 oz. **8.** 1205 lb. 5 oz.

Page 260. **1.** 5 lb. 13 oz. **2.** 8 yd. 16 in.; 1 yd. 20 in. **3.** 26 lb. 6 oz. **4.** 11 bu. 3 pk. **5.** 6 gal. 3 qt. **6.** 16 bu. 26 qt. **7.** 52 qt. 1 pt. **8.** 11 ft. $8\frac{1}{4}$ in. **9.** 34 ft. 6 in. **10.** 13 lb. 12 oz. **11.** 11 yd. 30 in. **12.** 37 A. 147 sq. rd. **13.** 48 sq. ft. 118 sq. in. **14.** 27 cu. ft. 1436 cu. in.

Page 261. **1.** 23,437 lb. 8 oz. **2.** 94 ft. **3.** 58 gal. 2 qt. **4.** 19 lb. 8 oz.

Page 262. **1.** 5 ft. $11\frac{1}{8}$ in. **2.** 1 ft. 11 in. **3.** 9° 32′. **4.** 2 hr. 52 min. 30 sec. **5.** 15 mi.; $37\frac{1}{2}$ mi.; $63\frac{3}{4}$ mi. **6.** $12\frac{1}{2}$ mi. **7.** $12{,}571\frac{3}{7}$.

Page 263. **1.** 1 min. 24.3 sec. **2.** 0.4 sec.; 1.3 sec.; 6.6 sec.; 4.6 sec. **3.** 1 ft. $11\frac{5}{8}$ in.; 9 in.; 30 ft. $8\frac{3}{4}$ in.

Page 264. **1.** 100 yd. **2.** $53\frac{1}{3}$ yd. **3.** 10; 40; 60. **4.** $9\frac{3}{8}$ yd. **5.** On his 35-yard line. **6.** $306\frac{2}{3}$ yd. **7.** 4840. **8.** Field; 4440 sq. ft. **10.** 76.

Page 265. **21.** 1296 sq. in. **22.** 9; 3. **23.** 4. **24.** 20. **25.** $4\frac{1}{2}$. **26.** 27. **27.** 1600. **28.** 640. **29.** 144. **30.** 36. **31.** 18,000. **32.** $4\frac{1}{2}$. **33.** 18. **34.** 36. **35.** 72. **36.** 36. **37.** 63. **38.** 108.

Page 266. **1.** 34 yd. **2.** 1 hr. 45 min. **3.** 1 hr. 33 min. **4.** Yes; yes; $3\frac{1}{2}$. **5.** 14 ft. 5 in. **6.** 12 ft. 11 in. **7.** 123 ft. **8.** 10 ft.; 20 ft. **9.** 4; 12; first. **10.** 31.

Page 267. **1.** 7 ft. 2 in. **2.** 11 ft. 7 in. **3.** 5 yd. 25 in. **4.** 13 yd. 31 in. **5.** 29 gal. 1 qt. **6.** 36 gal. 3 qt. **7.** 63 bu. 2 pk. **8.** 7 hr. 37 min. **9.** 4 ft. 3 in. **10.** 3 ft. 4 in. **11.** 1 yd. 12 in. **12.** 3 yd. 22 in. **13.** 4 gal. 2 qt. **14.** 17 gal. 2 qt. **15.** 3 bu. 3 pk. **16.** 7 hr. 30 min. **17.** 11 lb. 4 oz. **18.** 11 ft. 8 in. **19.** 10 hr. 20 min. **20.** 1 ft. 8 in. **21.** 1 yd. 20 in. **22.** 1 hr. 32 min. **23.** 11 oz. **24.** $5\frac{2}{3}$ qt. **25.** 3 qt.

Page 268. **1.** $\frac{5}{6}$. **2.** $\frac{1}{8}$; $\frac{1}{5}$. **3.** $\frac{9}{10}$. **4.** $2400. **5.** $6. **6.** $1.50. **7.** $3201.75. **8.** $27,125. **9.** $25.25.

Page 271. 1. $19\frac{1}{2}$ sq. in. 2. $36\frac{1}{4}$ sq. in. 3. 79 sq. in. 4. $83\frac{1}{4}$ sq. in. 5. 1748 sq. ft. 6. 2000 sq. yd. 7. 7200 sq. ft. 8. 4400 sq. yd. 9. 4875 sq. ft. 10. 1150 sq. ft. 11. 5208 sq. ft. 12. 7700 sq. in.

Page 272. 1. $\frac{1}{10}$. 2. $\frac{1}{4}$. 3. \$4. 4. Yes; $\frac{1}{8}$ sq. rd. 5. 3 pk. 6. 120. 7. \$11.70. 8. \$3; \$27; \$15.30.

Page 273. 1. $\frac{1}{10}$. 2. 2 ft. $9\frac{3}{4}$ in. 3. 210 sq. ft. 4. 3 ft. 9 in. by 6 ft. $10\frac{1}{2}$ in. 5. 90 sq. ft. 6. 90 sq. ft.; $152\frac{1}{4}$ sq. ft. 7. 568 sq. ft.

Page 274. 8. 160 sq. ft. 9. 80 sq. in.

Page 275. 1. 58 ft. 9 in. 2. 39 ft. 2 in. 3. 85 ft. 4. Yes. 5. 37 ft. 9 in. 6. $42\frac{1}{3}$ yd. 7. 29 ft. 5 in. 8. 27 ft. 7 in. 9. 10 ft. $6\frac{7}{8}$ in. 10. 15 yd. $1\frac{1}{4}$ ft. 11. 7 in. 12. 29 ft. 8 in. 13. 56 mi. 250 rd. 14. $33\frac{1}{2}$ ft. 15. 35.2 ft.; 35.2 ft.; 17.6 ft. 16. 8; 9; 7.

Page 276. 1. \$50. 2. 1. 3. $\frac{3}{8}$. 4. $1\frac{1}{8}$. 6. 1829. 7. \$91.40. 8. $1\frac{3}{4}$; $\frac{3}{4}$. 9. \$23.52. 10. \$189. 11. \$105.45. 12. \$129. 13. \$25.80.

Page 278. 4. $7\frac{1}{2}$.

Page 279. 1. $7508\frac{1}{4}$. 2. 354. 3. 81. 4. $776\frac{1}{4}$. 5. 576.

Page 280. 3. 168 sq. in. 4. 504 sq. ft. 5. 444 sq. ft. 6. $14\frac{7}{8}$ sq. in. 7. 1690 sq. ft. 8. 116 sq. yd. 9. 252. 10. 68.7 sq. in. 11. 880 sq. ft. 12. $9\frac{1}{4}$ sq. yd. 13. $65\frac{1}{6}$ sq. ft. 14. 1368 sq. ft.; 1368 sq. ft.; 1824 sq. ft.; 2280 sq. ft.; 5600 sq. ft.; 2000 sq. ft.; 5200 sq. ft.; 8000 sq. ft.; 8000 sq. ft. 15. 35,640 sq. ft. 16. 6840 sq. ft. 17. 2400 sq. ft.; 1800 sq. ft.; 3500 sq. ft. 18. 13,500 sq. ft.

Page 283. 7. 260.9 sq. in. 8. 520.9 sq. in. 9. 244.4 sq. in. 10. $806\frac{9}{16}$ sq. ft. 11. $8\frac{1}{6}$ sq. ft. 12. 4.3 sq. ft. 13. 62.4 sq. ft. 14. 54.4 sq. rd. 15. 600 sq. rd.

Page 288. 1. 142. 2. 17; 51. 3. 54. 4. 61. 5. 13. 6. 1039. 7. 893. 8. 8195. 9. \$1104.18. 10. 638 bu. 11. 21 ft. 1 in. 12. \$12.41. 13. \$12.22. 14. 16; \$2000.

Page 289. 5. 298. 6. \$2476.20. 7. \$205.76. 8. 698 yd. 9. 1231 bu. 10. 2176 mi.

Page 290. 10. 129. 11. \$1700. 12. 40 ft. 13. 93 mi. 14. 225 ft. 15. 1%. 16. $12\frac{1}{2}$%. 17. 35%.

Page 292. 1. \$2400. 2. \$2400. 3. \$30. 4. \$30. 5. \$31.25. 6. \$31.35. 7. \$94.05. 8. \$1400. 9. \$1500. 10. \$210. 11. \$211.02. 12. \$633.06. 13. \$2005.40. 14. \$2807.56. 15. \$43.20. 16. \$841.10. 17. No; last one. 18. \$27. 19. \$30. 20. \$1; 50¢.

Page 293. 1. $\frac{9}{25}$. 2. $\frac{16}{25}$. 3. $\frac{1}{4}$. 4. $\frac{1}{16}$. 5. $\frac{3}{10}$. 6. $\frac{5}{4}$. 7. $\frac{9}{50}$. 8. $\frac{15}{4}$. 9. $\frac{33}{40}$. 10. $\frac{1}{3}$. 11. $37\frac{1}{2}$%. 12. $62\frac{1}{2}$%. 13. $87\frac{1}{2}$%. 14. 20%. 15. 40%. 16. 60%. 17. 80%. 18. $6\frac{1}{4}$%. 19. $18\frac{3}{4}$%. 20. $106\frac{1}{4}$%. 21. 100%. 22. 350%.

Page 294. **2.** \$240. **3.** \$180. **5.** 0.25; 25%. **6.** $\frac{3}{4}$; 75%. **7.** $\frac{1}{8}$; $0.12\frac{1}{2}$. **8.** $0.37\frac{1}{2}$; $37\frac{1}{2}$%. **9.** $\frac{5}{8}$; $62\frac{1}{2}$%. **10.** $\frac{7}{8}$; $0.87\frac{1}{2}$. **11.** $0.33\frac{1}{3}$; $33\frac{1}{3}$%. **12.** $\frac{2}{3}$; $66\frac{2}{3}$%. **13.** $\frac{1}{5}$; 0.20. **14.** $\frac{3}{10}$; 30%. **15.** 0.40; 40%. **16.** $\frac{1}{6}$; $16\frac{2}{3}$%. **17.** $\frac{5}{6}$; $0.83\frac{1}{3}$. **18.** 1.25; 1.25; 1.25.

Page 296. **7.** \$81,000. **8.** 1203. **9.** \$80. **10.** \$60. **11.** \$52. **12.** \$48. **13.** \$40. **14.** \$32. **15.** \$24.

Page 297. **1.** \$2.40. **2.** 90¢. **3.** \$9.80. **4.** \$7.80. **5.** \$87.50. **6.** \$100. **7.** \$180. **8.** \$200. **9.** \$175. **10.** \$700. **11.** \$7200. **12.** \$14,080. **13.** \$360. **14.** \$330. **15.** \$600. **16.** \$1200. **17.** \$800. **18.** \$37.50. **19.** \$45. **20.** \$102. **21.** \$1729. **22.** \$3854. **23.** \$700. **24.** \$13,320. **25.** 50; 0.5; 50. **26.** 200; 2; 200. **27.** \$6; 60¢; \$60. **28.** \$10; \$100; \$100. **29.** \$250; \$25; \$2.50. **30.** 250; 250; 250. **31.** 200,000; 2000; 1000. **32.** 3,000,000; 30,000; 30,000.

Page 298. **1.** 1,125,000. **2.** 2,339,020. **3.** 100 carloads. **4.** $86\frac{1}{4}$ T. **5.** 35,658. **6.** 270,000. **7.** 114,400,000. **8.** 2800 ft. **9.** 13,146 ft.

Page 299. **1.** 28; 42. **2.** 22. **3.** 403. **4.** 260. **5.** 14. **6.** 36. **7.** \$1.06. **8.** $\frac{2}{5}$; 10; 15. **9.** $\frac{1}{4}$ yd.; $49\frac{3}{4}$ yd.

Page 300. **21.** $\frac{3}{50}$; $\frac{6}{100}$; 6%. **22.** 90%; 10%; 100%. **23.** 5%; 95%; 100%. **24.** 50%. **25.** 50%. **26.** 50%. **27.** 50%. **28.** 50%. **29.** 75%. **30.** 125%. **31.** 80%. **32.** $133\frac{1}{3}$%. **33.** 50%. **34.** 120%. **35.** $83\frac{1}{3}$%. **36.** 150%. **37.** $66\frac{2}{3}$%. **38.** 200%. **39.** 275%. **40.** $33\frac{1}{3}$%. **41.** 300%. **42.** 50%. **43.** 50%. **44.** 50%. **45.** 10%. **46.** 60%. **47.** 75%; 25%. **48.** 52%; 48%; 100%.

Page 302. **1.** 45¢; 50%. **2.** 54¢. **3.** Lose; 9¢. **4.** 75%; gain; 8¢. **5.** \$1.92; 32¢; 20%. **6.** 8%.

Page 304. **1.** \$160. **2.** \$281.25. **3.** \$27.50; \$522.50. **4.** \$20. **5.** \$187.50. **6.** \$262.50. **7.** \$395. **8.** \$281.25. **9.** \$586.25. **10.** \$562.50. **11.** \$790.50. **12.** \$2.51. **13.** \$11.02. **14.** \$442.80. **15.** \$508.30. **16.** \$7; \$273. **17.** \$13.80; \$446.20. **18.** \$18.90; \$521.10. **19.** \$28.90; \$651.10. **20.** \$27; \$693. **21.** \$18.45; \$801.55. **22.** \$15.95; \$564.05. **23.** \$67; \$1608. **24.** \$3.51; \$171.99. **25.** \$7.33; \$318.42. **26.** \$11.79; \$416.81. **27.** \$4.22; \$125.50.

Page 306. **1.** \$492. **2.** \$984; \$6396. **3.** \$460.80; \$940.80. **4.** 5¢. **5.** \$2518.75. **6.** \$1132. **7.** \$32.26. **8.** \$30.80. **9.** \$69.25. **10.** \$12. **11.** \$1.80. **12.** 48¢; \$92. **13.** \$2.12. **14.** \$4.90.

Page 308. **1.** \$5. **2.** \$7. **3.** \$4. **4.** \$10. **5.** \$12. **6.** \$8. **7.** \$12. **8.** \$15. **9.** \$18. **10.** \$21. **11.** \$3. **12.** \$30. **13.** \$300. **14.** \$3.75. **15.** \$37.50. **16.** \$375. **17.** \$1. **18.** \$10. **19.** \$100. **20.** \$125. **21.** \$6. **22.** \$6.75. **23.** \$8.25. **24.** \$4.80. **25.** \$4.40. **26.** \$42. **27.** \$460. **28.** \$262.50. **29.** \$345. **30.** \$450.

Page 309. **1.** \$36. **2.** \$20. **3.** \$30. **4.** \$40. **5.** \$60. **6.** \$18. **7.** \$15. **8.** \$20. **9.** \$42. **10.** \$16.50. **11.** \$27.50. **12.** \$450. **13.** \$525. **14.** \$3. **15.** \$9. **16.** \$12. **17.** \$15. **18.** \$75. **19.** \$6.50. **20.** \$36. **21.** \$100. **22.** \$80. **23.** \$540.

Page 311. **10.** \$1337.60. **11.** \$22. **12.** \$11.90. **13.** \$4.20. **14.** \$7.82.

Page 313. **1.** \$870.00. **2.** \$1483.75. **3.** \$2256.75. **4.** \$1786.00. **5.** \$955.99. **6.** \$600. **7.** \$480. **8.** \$575. **9.** \$942. **10.** \$402.30. **11.** \$4852.50. **12.** \$2112. **13.** \$2748. **14.** \$118.16. **15.** \$15.76. **16.** \$300. **17.** \$451.25. **18.** \$643.11. **19.** \$743.75. **20.** \$744.24. **21.** \$832.50. **22.** \$533.20. **23.** \$26.20. **24.** \$3613.72. **25.** \$4963. **26.** \$49.03. **27.** \$38.16.

Page 314. **1.** 112. **2.** 190. **3.** 270. **4.** 644. **5.** \$240. **6.** \$78. **7.** \$17.60. **8.** 16. **9.** 58.4. **10.** 83.25. **11.** 33.075. **12.** \$18.84. **13.** \$35.84. **14.** \$78.12. **15.** 927. **16.** 927. **17.** 927. **18.** 59. **19.** 59. **20.** 723. **21.** 723. **22.** \$600. **23.** \$403.75. **24.** \$660. **25.** \$897. **26.** \$1435. **27.** \$1349. **28.** \$1300. **29.** \$8547. **30.** \$3052. **31.** \$1232.50. **32.** \$1643.33. **33.** \$4120. **34.** \$62. **35.** \$6400. **36.** \$2296. **37.** \$6333. **38.** \$12,385. **39.** \$10,202.82. **40.** \$225. **41.** \$10,560. **42.** \$66.

Page 315. **1.** 60,300,209. **2.** 92.044. **3.** \$35.57. **4.** \$34.84. **5.** \$64.61. **6.** \$54.05. **7.** \$41.88. **8.** \$63.98. **9.** \$53.33. **10.** 4.526650. **11.** 5.46. **12.** $1\frac{5}{8}$. **13.** $\frac{5}{8}$. **14.** $\frac{1}{6}$. **15.** $\frac{11}{16}$. **16.** $\frac{7}{8}$. **17.** $\frac{3}{4}$. **18.** $4\frac{3}{8}$. **19.** $5\frac{5}{6}$. **20.** 0.84. **21.** 6.46. **22.** 0.21275. **23.** 1.2.

Page 319. **1.** 221. **2.** 43¢. **3.** 216. **4.** \$103.68. **5.** \$10.00. **6.** \$130.90. **7.** 48. **8.** \$129.27.

Page 320. **1.** 94. **2.** \$1.58. **3.** \$252.80. **4.** \$3.78. **5.** \$604.80.

Page 321. \$356.40; \$369.60; \$18.75; \$0.68; \$3; \$0.68; \$3; \$24.25; \$10; \$6.50; \$7.98; \$5.76; \$108.89; \$260.71.

Page 322. **1.** \$38. **2.** \$39.75. **3.** \$37.00. **4.** \$12.10. **5.** \$31.15; \$224.28.

Page 323. **1.** \$400. **2.** \$76.50. **3.** \$1122. **4.** \$906.40. **5.** \$2625; \$6125. **6.** \$1050. **7.** \$2100. **8.** 63.60 ft. **9.** 0.022 in. **10.** 6082.56. **11.** \$4050.00.

Page 324. I. **1.** 750 in. **2.** 58 qt. **3.** 170 qt. **4.** 210 min. **5.** \$13.19. **6.** \$7,070,443. **7.** \$1,602,838.72. **8.** \$7,562,406.25.

II. **1.** 4 rd. **2.** 7 sq. yd. **3.** 5 A. **4.** 2 mi. **5.** 1615 sq. ft. **6.** $147\frac{1}{4}$ sq. ft. **7.** 48 ft. 4 in. **8.** 49 lb. 8 oz.

III. **1.** 2 sq. mi. **2.** $6\frac{1}{2}$ hr. **3.** 11 ft. 9 in. **4.** 6 ft. 10 in. **5.** 5 yd. 27 in. **6.** 74 ft. **7.** 98 yd. **8.** 392 sq. rd. **9.** 16 sq. ft. **10.** $25\frac{1}{2}$ sq. ft.

IV. **1.** $65\frac{1}{6}$ in. **2.** $1\frac{5}{8}$ in. **3.** $41\frac{9}{16}$ in. **4.** $1\frac{55}{71}$. **5.** 2.30. **6.** \$4.20. **7.** \$3.65. **8.** 9 ft. **9.** 15 ft. 2 in. **10.** $10\frac{11}{16}$ lb.

V. **1.** \$1.41. **2.** \$12.05. **3.** \$36.60. **4.** \$26. **5.** \$37.80. **6.** \$16.25. **7.** 14¢. **8.** \$7.56. **9.** \$1.75. **10.** 450 ft.

cwt = Hundredweight

M = 1000

C = 100

8	1	6
3	5	7
4	9	2